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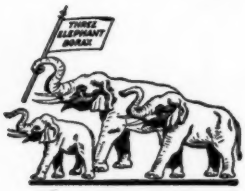

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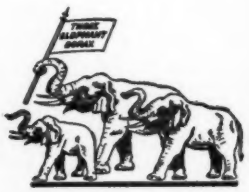

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Better Crops with PLANT FOOD

The Whole Truth—Not Selected Truth

R. H. STINCHFIELD, *Editor*

Editorial Office: 1155 16th Street, N. W., Washington 6, D. C.

VOLUME XXVII NUMBER 8

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COTTON IS EASIER TO PICK WHEN IT YIELDS TWO BALES PER ACRE.

Better Crops with Plant Food

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Vol. XXVII WASHINGTON, D. C., OCTOBER, 1943 No. 8

In Honor of a Great Public Servant

Oneida County Salute!

Jeff McDermid

I AM dedicating this piece to Oneida county, New York. I am doing so because it marks the centennial anniversary of the birth of an old friend of mine, who did more for the welfare of the country in general than John Humphrey Noyes and his brethren of the steel trap and chain community, who also hail from Oneida; or more than the good Indians from the vicinity of Oneida Castle, who migrated to Green Bay, Wisconsin, nearly seventy-five years ago.

I'd like to know more about Oneida county, a land of Iroquois tradition, a region of good farms and peaceful valleys—a section where the place names usually end in "Mills" and "Falls" and "Station;" a county with such famous old landmarks as Utica and Rome tracing the westward flow of the folks who came out here to make us civilized.

I'd like to snoop around Oriskany Falls and Vernon, and on east to Cassville, and then bend south to Cedar Valley and vicinity. From there I'd get a fill of gas (oh, yes?) and trek back into the bluffs northeast, rubbing close to the Herkimer county line. There I'd spot a knob called Babcock Hill. Babcock Hill is on the map, too, and it had better be, because my re-

spects are addressed to it and to the family from whence it derives its name.

To end the suspense, I'll say this is no tribute to some general of the ramparts or some admiral of the sea, but a humble screed written in memory of a Man and his Idea, or perhaps I should say an industrial revolution—the late Stephen Moulton Babcock, whose father plowed the land north of Bridgewater with oxen on that October day in 1843 when his famous son was born.

About forty-four years later, this promising son became a dairy chemist and physicist and settled in Madison, Wisconsin, where he lived in a simple frame house without a telephone for another forty-four years, and had more folks tramping to see him than all those mouse-trap guys ever had in the Oneida community.

BETWEEN chuckles, he used to tell me about the way they watered the milk and spied on each other back in Oneida county in his boyhood. His father, like many other New Yorkers of those times, was a sheep farmer above everything else, but when western flock competition began to cut their profits, the Oneida, Herkimer, Orange, and Madison county farmers drifted into dairying. Durhams were, of course, one of the first milk breeds, and at New York Mills near Rome they held the famous consignment sale of the Dutchess strain of Shorthorns.

By the time Stephen was ready to attend Renssalaer Polytechnic Institute at Troy, his pride in local dairy achievement was justified, because the prize-takingest butter came from Orange county, and the strongest and smellingest cheese came from just ferninst the border beyond Babcock Hill in Herkimer county meadows. And when I say "meadows" I mean it, as the dairy manufacture of those times was conducted strictly as a home-farm enterprise, leading to the above-mentioned habits of neighborhood hawkshawing, owing to mutual suspicions about yields in general. But anyway, he did not stay very long at Troy, as engineering was not his forte. Cornell became his mecca, and Professor Caldwell his inspiration. So the young Oneida county farm lad rented twenty acres known as the old Schuyler farm at Ithaca, and started in to improve himself the hard way on the hills above Cayuga's waters.

After he finished his course there and taught awhile, mixed with some plowing and milking back at Bridgewater, the urge to go abroad and study under European chemists got the best of Stephen. So he spent a year or two at Goettingen University in Germany, bringing back the most trustworthy of Teutonic traits, thoroughness. That trait, plus a little stubbornness he got honestly from New England ancestors, probably combined to pave the way for his subsequent triumph.

As a sort of preface to what follows, I'd like to insert a few direct quotes given me by Dr. Babcock in 1928, the year the Holstein national convention was held in Milwaukee. When the officers wanted to "escort" him down, he refused to be coddled and came alone. These memoirs by him serve to show the background leading to his later Wisconsin invention.

"All the country around Little Falls was then the greatest cheese center of the world, and it was all farm-made cheese," he said. "Much of it was skim-milk cheese, because it was customary for farmers to put the night's milk in the vats and then skim off a little cream in the morning. They also made butter to sell in those days, but there were no standards. There were as many different grades as there were farms.

"ONE of the first farmers to make a sound reputation for uniform, high quality cheese was a man named Williams, who lived near Rome. After his business grew beyond his ability to meet the demand, he got his son-in-law to pool milk with him and they made cheese together. This attracted the attention of the neighbors, and so they got into the habit of pooling milk

at the Williams farm for cheese making because he had a knack in producing a better-than-average article.

"Of course most of the cows were natives, rather poor grades as we would call them now. Milk was milk and cheese was cheese—that's all there was to it, and we didn't have any test. But we had plenty of detectives just the same. You see, the ones who made cheese at home got certain yields from

their herds, and so when they took milk to a farm factory and did not get what they presumed they should, it started them guessing.

"Some of them believed that watering and skimming was going on in the community, and I suppose it was too. This led to a lot of poking and peering around to find out what the other man was doing or not doing." (I interrupt to say that the Doc himself was no slouch at poking and peering and wondering and cogitating, and if he hadn't been, we'd still be watering our lactic fluids.)

To continue with his reveries: "It was about this time that I went to Geneva Experiment Station as a student, and later as a staff member there. Lots of claims were being made about yields of butter, some of them claiming to get a pound of butter from three and a half pounds of milk. The best test we had then was the mechanical oil test for butter.

"At last I persuaded Dr. Sturdevant of Geneva that what we needed was a chemically controlled dairy test, something that could be standardized and simple enough to operate in common usage. Thereupon he wrote to The Country Gentleman, then published at Albany, and stated that he would furnish a chemist from the Station to any resident of New York who wished to try a chemical test on his herd.

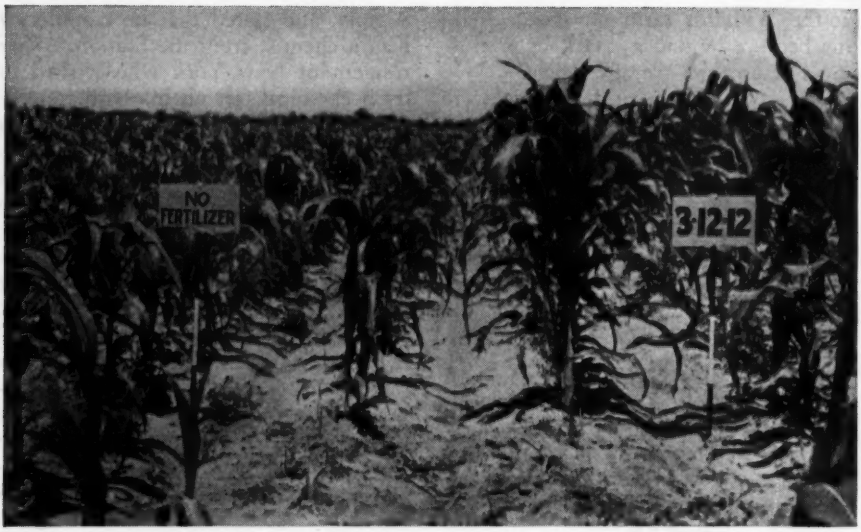
"At that time, Edward Brunson was president of the American Jersey Cattle Club. He was a progressive man and owned a herd just over the state line near Southport, Connecticut. He appealed to Dr. Sturdevant to let him be the first man to try a chemical test for his dairy cows. So I was sent over to Southport with Ed Burnett, a dairyman of prominence and ability, and a member of congress. I used the gravimetric test on that herd for the first time, assisted by Mr. Burnett. We stayed with the herd a week and Brunson was well satisfied that some such mode of testing was bound to work out for the advantage of both farmers and cattle breeders.

"FROM that time onward the belief was general that a controlled chemical test, a modified one to be sure, must be developed for the dairy industry. It was only a short time after that experience when I was called to Wisconsin, where I began work with Dean William A. Henry at Madison, still hoping to evolve an accurate and scientific test that could be used in a practical way."

During this interval prior to his Wisconsin journey, Dr. Babcock tested several herds in the vicinity of Geneva, using the gravimetric test. The Smith & Powell Holsteins tested around two per cent butterfat or a little above. Today the average black-and-white cow tests more than one per cent better. Dr. Babcock predicted that the larger volume of Holstein milk would more than make up for the lower fat content. But for a long time the men with this breed were the shy boys in accepting any fat test.

Nor were these things any different when Stephen began working in Dane county, Wisconsin. Some of the early plants out there had experimented with the Curtis oil test so that their patrons

(*Turn to page* 51)



On limed soils that are less than medium in organic matter and where definite potash-deficiency symptoms develop in the crops grown, complete fertilizers comparatively high in potash should be used. This picture was taken on limed gray prairie soil of northeast Missouri.

Meeting the Needs For the 4 F's

By O. T. Coleman

Agricultural Extension Service, Columbia, Missouri

MAXIMUM production of foods, feeds, fiber, and fats can be reached only when the soil is well supplied with organic matter and there is an adequate and well-balanced supply of the essential plant-food elements available to the crops grown. Under Missouri conditions, and in states where the situation is similar, this can best be attained by following a well-balanced farming system which includes the frequent use of legume crops, maximum utilization of all feed crops by good livestock, the return of all farm manures and crop residues to the land, and the use of sufficient amounts of such commercial fertilizers as will provide an adequate and well-balanced plant ration.

The thoroughness with which this complete plan is carried out is the most important factor in determining the kind and amounts of the various fertilizer elements that should be used for most profitable returns. Furthermore, the more efficient is the cropping and crop-utilization plan in supplying the necessary organic matter and nitrogen to the crops grown, the more nearly will the fertilizer industry be able to supply the plant foods needed for maximum production. This is explained by the fact that in order to attain highest production of good quality crops there needs to be, as nearly as possible, a balance between the nitrogen, phosphoric acid, and potash in the soil in

available form and in sufficient quantities to meet the needs of the crops for all of these essential plant foods.

Since the inorganic nitrogen formerly used in commercial fertilizers is now needed in the manufacture of war explosives, and increasing amounts of organic nitrogen in the form of oil meals and tankage are needed as supplemental feeds for our greatly expanded livestock industry, more dependence needs to be placed upon the efficient utilization of such farm-produced nitrogen as well-inoculated legumes, farm manures, and crop residues. Present indications are that there will be a sufficient supply of phosphoric acid and combinations of phosphoric acid and potash fertilizers available, and so long as there is sufficient transportation facilities to deliver these to farmers, fertilizer manufacturers should be able to meet the needs for these plant foods.

Phosphate and potash fertilizers give a greater return for each dollar invested in them when applied to soils well supplied with organic matter. Because of this, every effort possible should be made to provide a good turnover of farm-produced organic matter and nitrogen and to balance this through the use of phosphoric acid or mixtures of phosphoric acid and potash fertilizers. Furthermore, when it is realized that over 90 per cent of the plant food available for plant growth often comes from the rotting down of organic matter in the soil, the value of those cropping and crop-utilization practices which will provide a good turnover of this life-giving substance to the soil is appreciated.

For instance in a good livestock system, more organic matter and nitrogen can be returned to the soil in the form of manure and more crop residues can be utilized for bedding and roughage than where cash crops are grown and sold directly from the land. When legume crops are pastured off, they are about three-fourths as effective in adding nitrogen and organic matter to the soil as when the whole crop is turned under. Likewise, when non-legume crops are pastured off, they deplete the soil in organic matter and nitrogen only about one-fourth as much as when the whole crop is removed from the land. The same is true to a certain extent when crops are fed to livestock and all the manure saved and returned to the land.

There is, however, likely to be more loss of nitrogen and potash from leaching or the loss of nitrogen to the air in the form of gas when crops are fed and the manure is hauled and spread on the fields than when crops are pastured off and the manure falls directly on the land. These losses will, however, be reduced to the minimum when the manure is properly stored or hauled to the field and worked into the soil shortly after it is voided. Furthermore, when legume crops are properly grazed through the growing season, they may continue to add some nitrogen and organic matter to the soil; but when they are plowed under, this process is stopped.

Determining What Fertilizer to Use

Because of these conditions, it is important in determining fertilizer recommendations to know not only what crops have recently been grown on the land but how they have been utilized. Also, since legumes add only nitrogen and organic matter to the soil while barnyard manure returns some phosphoric acid and potash in addition to organic matter and nitrogen, it is important to know the source of the organic material used. If this is not considered, it is possible to apply the wrong proportion of the different fertilizer elements and not attain the most productive balance of plant foods in the soil.

Since the barnyard manure and crop residues produced on the average farms are not usually sufficient to furnish the amount of nitrogen needed by the plants grown and provide an adequate turnover of organic matter, legumes should be grown rather frequently in cropping systems. In order to grow legumes most successfully, make them

The importance of lime in the production of sweet clover is shown in the picture above. The effect on the following corn crop of the organic matter and nitrogen added by the sweet clover is shown in the picture below.

more efficient in adding nitrogen and organic matter to the soil, and add to their value as a livestock feed, lime should be applied to lime-deficient soils and sufficient phosphate or phosphate and potash fertilizers used in the cropping system to balance the nitrogen so added. Phosphoric acid is usually needed on all but the most fertile soils. After the organic matter and nitrogen supplies have received consideration, this plant food generally should come next.

Although there is normally a fairly large total supply of potash in the soil, the available supply of nearly all of this element, like the nitrogen, centers about the breaking down of the organic matter in the soil. For this reason, both potash and nitrogen are needed, in addition to phosphorus, on those soils where a good turnover of organic matter has not been maintained. Potash in addition to phosphorus may also be needed to balance the nitrogen on limed soils where large amounts of nitrogen have been added by the growth of heavy crops of legumes, especially if they are pastured off, combined, or turned under

The acre yield of corn on the limed plot at the left was 41.1 bu. while that on the unlimed plot at the right was 32.4 bu. (Missouri Agricultural Experiment Station, Columbia.)

rather frequently in the cropping system.

Since barnyard manure is comparatively high in both nitrogen and potash but low in the phosphorus needed by most soils, a much better plant-food balance is attained, and hence larger returns secured per ton applied, when superphosphate fertilizers are used on the crops grown or 20 to 40 lbs. of 20 per cent superphosphate are spread on the manure and applied with it. Even with manure and phosphate, however, the most successful production of legumes will not be obtained on lime-deficient soils unless limestone is applied.

If the crops grown show indications of potash-deficiency symptoms, fertilizers with a greater proportion of potash, such as a 3-12-12, 3-18-9, or 2-12-6 should be used. Since fertilizers containing nitrogen are not now available on the market for general use, it makes it more difficult at this time to properly fertilize crops grown on soils low in organic matter. Furthermore, it is more expensive to properly fertilize land low in organic matter because the nitrogen in fertilizers is usually much higher in price per pound than is phosphoric acid or potash.

Showing the comparative effects of phosphate alone, and phosphate and potash on corn and castor beans grown in a 3-year rotation with small grain and red clover at the Missouri Experiment Station, Columbia. The treatments applied and the acre yields for this (1942) crop were as follows: Right half—lime and phosphate—corn 59.7 bu., castor beans 1,608 lbs. Left half—lime, phosphate, and potash—corn 62.2 bu., castor beans 1,833 lbs.

The kinds and amounts of available plant foods in the soil, which largely depend upon the natural fertility of the soil, the previous crop and crop-utilization practices, and the soil treatments applied within the last year or two, normally furnish a better guide to the kind of fertilizer to use than the kind of crop to be grown. For instance, where the soil is low in organic matter and where no crops or only poor crops of legumes have recently been grown on the land and where no manure or crop residues have been applied within the last year or two, a complete fertilizer like a 4-10-4, 4-12-4, or 4-16-4, or possibly a 4-10-6 or 3-9-6, usually gives best results.

Where soils are only moderately well supplied with lime and only fair legume crops have been grown in the rotation or where manure has been applied rather infrequently in the cropping system and there is only a fair amount of organic matter in the soil, possibly those fertilizers containing only phosphate, such as 0-20-0, 0-18-0, or 0-45-0, would be advisable. On the other hand, if the soil is well supplied with lime and heavy legume crops have been grown consistently in the rotation, potash-deficiency symptoms may become rather pronounced. In such cases those fertilizers containing no nitrogen but

equivalent amounts of both phosphate and potash, such as 0-20-20, 0-14-14, or 0-12-12 will, no doubt, pay best.

Under average conditions of legume production and where only slight indications of potash deficiency are beginning to show up, possibly those fertilizers containing only half as much potash as phosphorus, such as 0-20-10 or 0-14-7, would likely be the more desirable ones to use. In some cases cotton rust or other deficiency symptoms may be an indication of the need for still more potash. Under such conditions, especially where a good turnover of organic matter has been maintained, a fertilizer containing two or possibly three times as much potash as phosphorus, like an 0-10-20 or 0-12-36 may be advisable.

Potash-deficiency symptoms can often be readily detected by the appearance of whitish spots in crops with netted veined leaves, such as clovers, alfalfa and lespedeza, and stripes in parallel veined leaves such as corn, sorghums, grasses, and small grains. These stripes usually appear near the edges, resulting in what is commonly known as marginal scorch. The continued growth of the green portion may cause either a ruffled appearance of outside edges of corn, sorghums, grasses, or small grain leaves, or a cupping of roundish shaped leaves like clover, alfalfa, and lespedeza. Later the dead tissue may fall out, causing the edges to become ragged. In corn and sorghums, the stalks often weaken and fall over. In more extreme cases many plants may be found elbowed up, or the small grains may lodge or go down badly. Also, where potash is deficient for the proper growth of corn and sorghums, the internodes may fail to lengthen, and some plants may be very short, with closely spaced leaves. On the other hand, a large supply of available potash in the soil may tend to slow up maturity but may cause a marked vigor in growth and increase the resistance of the plants to adverse weather conditions and the attacks of plant diseases.

Grasses, cotton, and such leafy vegetables as lettuce, spinach, cabbage, etc., the leaves of which are eaten, seem to require more nitrogen than do most

(*Turn to page* 45)

An application of superphosphate made this difference in the early growth of wheat on unlimed soil in the southwest Missouri prairie region.

Asking the Plant What Food It Needs

By M. E. McCollam

San Jose, California

CHEMISTRY has been looked upon throughout the long years of agricultural development as a most useful tool in attacking some of the problems of crop production. The appraisal of soil fertility is one of the main problems to which chemistry has been thus applied, and many methods of analyzing soils have been devised in the hope of finding out how much available plant food exists in the soil and how soil fertility may be maintained or improved.

Soil testing by chemical methods has become an important guide to fertilizer practice wherever enough experience with the test, the soil, and the crop has permitted intelligent conclusions.

In numerous instances, however, the soil test has seemed inadequate for determining fertilizer needs. Some regions have such a variety of soils and so many different crops growing on them that enough experience to interpret intelligently a soil test under such varied agriculture seems to be an insurmountable achievement. Soil testing under these conditions has resulted in considerable confusion and lack of confidence in the test, even though a soil test can be a very valuable piece of information to have.

Recently, there has been a growing interest in the chemical analysis of leaves of plants as a means of telling how much the plant is getting from the soil and what it needs in the way of fertilizer application. In addition to regular laboratory analysis, rapid chemical tests have also been devised for testing leaf tissue. Actually, this means getting a great deal closer to the plant itself in our application of chemistry. We are "asking the plant what it needs" rather than "asking the soil".

As a matter of fact, several cases have been studied recently where the soil tests showed the soil to have enough of a certain plant food, but leaf tests showed that the plants growing on the soil were suffering from a lack of that very plant food. The opposite situation has also been observed, where the soil test showed a lack of a certain plant food but the leaf test showed that the plants were getting an ample supply. The "story" told by the leaf tests in each case was proven true by applying the fertilizer in question. In the former case, the plants responded; in the latter case, the fertilizer was not effective.

Value of Leaf Analysis

The use of leaf analysis for arriving at the fertilizer needs of plants opens up a very promising new field of practical value to the grower. It may be possible for him to survey more accurately his fertilizer needs by having samples of plant leaves analyzed. If the leaves contain certain optimum levels of the plant foods, he will not need fertilizers. On the other hand, if the level of any of these elements in the leaves is below the optimum, he can then apply the fertilizer to build up this level, with reasonable assurance that he is making a sensible expenditure.

It is necessary to know the critical levels of plant-nutrient elements in the

leaves of various crops before a leaf analysis can be interpreted. Considering potassium in the case of peaches for instance, we may say that if the leaves contain 0.5% potassium, it means a deficiency level. If the leaves contain between 0.5% and 1.5% potassium, it means a response level; that is, if we apply potash to such peach trees, there is a good chance for response. If the leaves contain above 1.5% potassium, it means an optimum level and applications of potash would not be needed. These potassium figures which have been arbitrarily set for peaches may or may not apply to other classes of crops, and it will be necessary through research to arrive at these critical levels for various crops.

Just as it is important in soil testing first to get the right kind of a soil sample, so it is necessary to establish some constant or standard procedure in taking leaf samples; otherwise, one set of leaf analyses could not be compared with other leaf analyses of the same crop. A great many leaf samples for potassium analysis have been collected during the past few years from peach trees, prune trees, citrus trees, grape vines, and Ladino clover. The procedure on deciduous trees has been to collect the leaves from the basal area of the new wood growth. On grapevines, the first mature leaf on new cane growth is taken. With clover, small handfuls of clover are plucked from the field at regular distances while walking across the field, and all of this material is put together in one composite sample of the field. Large fields require that several such composites be taken. Citrus trees, because of their evergreen characteristic, present the problem of collecting leaf samples which will always be composed of leaves of the same age. It has been decided that leaves collected from the spring cycle of growth are suitable from the standpoint of known age for leaf analysis.

The content of plant nutrients in leaves also varies with the time of year the leaf sample is taken. It is important, therefore, to collect leaf samples of any one crop at approximately the same time of year, if the analyses made are to be comparable. Referring again to potassium content of leaves, it has been found that leaf samples collected at a certain time of year are most expressive of the potassium status in certain crops. With peaches, leaf samples are best collected in mid-June or early July, Ladino clover during June, citrus during July and August, and grapes during July. If leaves are collected too early in the season, potassium content may be uniformly high; if too late in the season, the content may be uniformly low.

From this discussion, it will be seen that method and time of collecting the leaf sample have a great influence on the results of the analysis; and in order to be reliable, the best procedure of taking the leaf sample must be worked out and then strictly followed for the crop in question.

Shortcomings of Leaf Analysis

In using leaf analysis to gain a solution to some of the problems of crop production, it may not be possible in some cases to take advantage of the information obtained during the current crop year. Obviously, the taking of leaf samples must be delayed until the crop is growing and leaves are available. However, it will always be possible to take advantage of the knowledge gained through leaf analysis during the following year, or in the case of annual crops, when the same crop is again grown on the same piece of land.

All methods devised by man for solving the complexities of plant and soil behavior will have their shortcomings. Leaf analysis is no exception, but information gained from the rapidly growing volume of plant-tissue testing and laboratory analysis of leaves gives promise that a better method has been found whereby fertilizers may be even more effectively utilized for the profitable production of our crops.

The topography in a large part of the Island of Puerto Rico is conducive to rapid erosion. Note contour-farming practices on some of the steep slopes in the foreground.

Soil Conservation In Puerto Rico

By T. S. Buie

Regional Conservator, Southeastern Region, Soil Conservation Service, Spartanburg, S. C.

ONE of the toughest jobs of soil conservation to be found anywhere is in the Island of Puerto Rico, strategic outpost of the Western Hemisphere in this global war. An exceedingly heavy annual rainfall, ranging up to 200 inches a year in some parts of the Island, and near desert conditions in other areas, combined with a tremendous population pressure on the land and the cultivation of excessively steep slopes are factors which make the conservation problem difficult enough in normal times. Under wartime conditions, with the heavy import and export trade of the Island virtually cut off and the people largely dependent on their own food production, the problems of the Island have been greatly intensified, while the need for a sound conservation program has correspondingly increased.

Lying athwart the trade lanes of North, South, and Central America, Puerto Rico has had a stormy history since its discovery by Columbus on his second voyage across the Atlantic in 1493. For many years, the Island was harassed by the enemies of Spain as well as the pirates and freebooters who roamed the Spanish Main. The resources of the Island have been recklessly exploited. The aboriginal population has been exterminated, the native forests have been destroyed, and nearly all forms of wildlife, except the

smallest birds, have been wiped out. And yet, when seen from the blue Caribbean, this "Pearl of the Antilles" still presents a lovely vision to the eye.

At the close of the Spanish-American War in 1898, Puerto Rico was ceded to the United States, and in 1917 the people of the Island were granted United States citizenship. Conditions have been considerably improved under United States rule, but the increase in population that has followed has served to intensify problems on the land. A recent study by the U. S. Department of Agriculture War Board in Puerto Rico showed that if every arable acre on the Island could be planted to a staple crop like rice and good yields obtained, the production still would fall short of the food requirement of the population.

The food problem is further complicated by the fact that most of the edible crops produced represent starchy foods, with a low production of proteins. Dr. George W. Bachman, Director of the School of Tropical Medicine, conducted an experiment with monkeys in which he reported that the animals did very poorly when fed on native diet, but that there was very prompt and marked improvement when the diet was varied to include protein in greater quantities. Calcium and phosphorus deficiencies also were reported as prevalent. The average child in Puerto Rico grows to maturity without so much as seeing a glass of milk.

Sugarcane, which is the principal crop, is produced all around the coast on the best adapted areas for crop production and creeps up onto the steep slopes in the hills. The economy of the Island is dependent upon the production of sugarcane, which is grown by both large landowners and small farmers and cultivated with equipment ranging from the most modern power machinery on the larger sugar plantations to ox-drawn implements and hand tools on the smaller farms. On the south and part of the north coast, irrigation is used for the production of sugarcane and hydro-electric power is developed with the water as it is brought down from the hills.

The annual book of statistics of the Department of Agriculture and Com-

Resettler's home in the Cayey area. Note attempt of resettler to beautify grounds with shrubbery. Banana plants can be seen at right of the house, and beginnings of bench terraces in background.

merce of Puerto Rico for 1939-40, covering the last year before the effects of the war were felt on export and import trade, gives the value of sugar exported as $57,328,790. Its next competitor was tobacco, valued at $6,028,724. Tropical fruits were valued at $1,479,819, and coffee grown principally in the mountain regions, at $421,910. Other crops include pineapples, bananas, plantains, sweet potatoes, yautias, yucca, cotton, corn and many minor crops of a truck or subsistence nature. As indicated above, lowlands with deep soils are used for sugarcane, the deeper mountain soils for coffee, the scattered thinner soils for tobacco, and the eroded, very shallow, and rocky soils for pastures. The many small, diversified farms are scattered over all soil formations.

Puerto Rico is small in comparison with the average state in the Union. It is a little more than 100 miles long and 35 miles wide and has a population of approximately 2,000,000. Some idea of the population pressure on the land can be realized from the fact that, although a large part of the Island is sparsely inhabited, there are approximately 500 persons per square mile for the island as a whole, or nearly one person per acre for every acre of land. During recent years there has been a considerable influx of people from rural areas to the towns, owing to the difficulty of making a living on the land. The rapid advance of erosion has been one of the principal factors in bringing about this condition.

Cooperative Service

Soil conservation operations in the Island are being carried out as a part of the work in the Southeastern Region of the Soil Conservation Service, which includes nine southeastern states, Puerto Rico, and the Virgin Islands. Preliminary soil conservation work began in 1936 in cooperation with the Puerto Rican Reconstruction Administration, which had purchased several thousand acres of land and divided it

View of houses at the edge of Isabella II, largest town on Vieques Island.

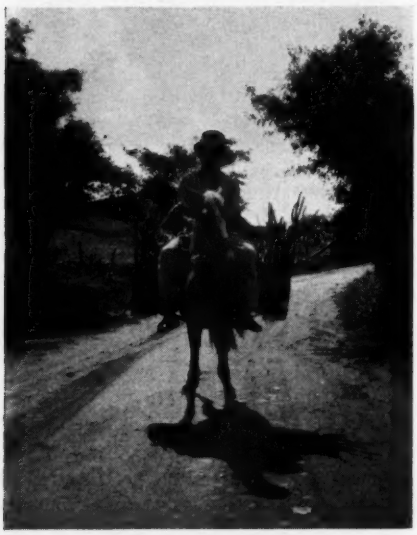
up into parcels ranging from 1 to 3 acres, and in some cases up to 20 acres, for resettlement of families. The Service provided for these small farms detailed conservation plans developed in cooperation with the farm superintendent and the county agent.

This cooperative program was spread for the most part on steep mountainside farms throughout the Island and required a staff of more than 60 native technicians. The administrative and technical procedures for carrying out the conservation program were patterned after those employed on the mainland, but modifications and adjustments were necessary to meet local conditions peculiar to the Island.

In the spring of 1940, the Soil Conservation Service extended its facilities to private lands, on account of the interest shown by farmers in the conservation program and the need for a wider application of conservation practices to all farm land, especially in the mountainous sections.

Under a law passed by the Insular Government in 1941, a three-man conservation committee was established, with the Commissioner of the Insular Department of Agriculture and Com-

merce as chairman. The other two members are the Director of the Insular Experiment Station and one member designated by the Secretary of Agriculture, who is director of the Soil Conservation Service work in the Island. This committee has general direction of the conservation program. Since discontinuance of the Puerto Rican Reconstruction Administration, funds for the Conservation Committee have been provided by the Insular Government.



Transporting wood on horseback to be burned for charcoal. Facilities for getting farm products to market in Puerto Rico are very primitive.

The Soil Conservation Service early recognized the need for encouraging increased food, fiber, and vegetable oil production on account of the increasing shipping difficulties and the necessity of self-sufficiency of the local people in case of a blockade. Consequently, in planning and operations of the Soil Conservation Service and other agencies, increased food production has been stressed through more efficient land use, establishment of soil and moisture conservation practices, and the use of better cultural practices.

The most effective work the Service is doing is in providing better use of available soil resources. In the drier areas, farmers normally planted only one crop a year, and if the season was especially dry, they got little out of it. Crop sequences now provided for in farm conservation plans enable them to grow three or four crops a year during the continuous growing season.

Moisture conservation on cultivated and pasture land obtained through contour planting of crops and contour furrowing of pastures helps overcome the hazard of droughts. Where spring water or streams are available, small farm irrigation systems are planned and installed as a part of the conservation program. Dry areas are often the most fertile, and by providing moisture through irrigation or conserving the available supply by contour farming, an immediate increase in production can be obtained.

There seems to have been no appreciation of contour cultivation in the Island before the advent of the Soil Conservation Service, and rotations were virtually unknown. Crops were generally planted up and down the hill and, since slopes ranging up to 40, 60, and even 80 per cent are regularly cultivated, the destructiveness of this practice in a region of tropical rainfall can readily be imagined. One of the most important phases of the work undertaken by the Soil Conservation Service is to have all crops planted on the contour. A sound conservation program, however, requires supporting practices for erosion control on the steep slopes.

One not familiar with the topography of the Island can hardly realize the steepness of some of the slopes that are in cultivation. Only sure-footed oxen, generally referred to as "bulls," are used to cultivate the steep slopes, while horses and burros are used only as pack animals. U. S. Allison, Director of Soil Conservation Service work in the Island, reports that even the bulls sometimes "fall out of the fields" and roll down the hillside until they come to a path, road, or other level area.

Allison tells of having seen farmers tie one end of a rope around their waists and the other end to a bush or other firmly anchored object to keep themselves from "falling out of the field" while they cultivate their crops with hand tools. In one case, he relates, he saw a farmer use a ladder to plant tobacco in a field. The farmer would lean the ladder against the hillside, climb up and plant as far as he could reach on each side, and then come down and move the ladder to a new position.

These, of course, are extreme examples, but they do give an idea of the type of land the people are forced to cultivate and of the imperative need for a sound conservation program, not only to aid in increasing wartime production, but also to prevent the limited soil resources now available from being destroyed.

Another primitive custom in the Island. Native pounding husks from coffee with mortar and pestle.

It was recognized early by the Soil Conservation Service that some type of bench terrace would be necessary if the steep slopes were to be cultivated, and the experiment stations at Mayaguez and Rio Piedras cooperated in the development of a type of bench terrace adapted to conditions on the Island. Some of the first work of this kind was the construction by hand of bench terraces on steeply sloping fields of the experiment stations to make available complete terraces for observation and study. In a few cases, rock retaining walls were constructed to serve as the face or riser of the terrace.

The method of construction developed for actual farm use consisted of plowing a furrow on the contour and planting elephant grass or some other stiff-stemmed or reed-like grass above the furrow to form a vegetative barrier. Trash and rocks from the fields are also sometimes used as a barrier to form a bench terrace. The barriers are spaced at a vertical interval of 4 to 6 feet. Formation of the bench is accomplished by the movement of the soil downhill against the barrier.

Ridge and channel-type terraces, such as are used in the Southeastern States, were not generally adaptable to conditions in Puerto Rico, but could be used on more gentle slopes. On the Island of Vieques in the Puerto Rican group, where the soils are very shallow and where slopes in some areas are not steeper than 12 to 15 per cent, a design combining principles of both the Mangum and the Nichols terrace was found very effective.

The bench terraces usually are sloped back toward the riser of the terrace above, at the base of which the terrace channel is located. The steep slopes and high rainfall make provision for water removal a serious problem. Fortunately, most of the fields are small and the water can be dealt with in units of small volume. The porous nature of the soil results in high absorption. Vegetated outlet channels, sodded with Bermuda, carpet, or similar grasses, are used to handle water from terrace channels.

In addition to contour tillage, terraces, outlets for water disposal, and small farm irrigation systems in the

Plots of tomatoes, Chinese cabbage, and turnips growing on bench terraces in the Mayaguez area. Tillage tests were made on this area.

drier areas, other conservation practices in the complete program include rotations and strip cropping, both of which are quite different from the practices used on the mainland, and pasture improvement. The principal work that has been done with pastures is the development of contour furrows for soil and moisture conservation, fertilization, and seeding.

The continuous growing season has made it necessary to develop an entirely different concept of rotations from that in the States, and the practice followed is generally referred to as "crop sequences" rather than rotations. The use of plants suitable for erosion control, preferably with food qualities, is emphasized.

Strip cropping as practiced in the States is not particularly well adapted to the Island because of the small size of the fields and the lack of opportunity to establish well-planned strip rotations. However, strip cropping is approached through the planting of alternate terraces in different crops in the crop sequences. In areas where conservation work has been done, a hillside seen from a distance presents a definite contour pattern with a visible variation in the strips.

Field surveys indicate that the acreage of most food crops has been doubled on the more than 4,000 farms on which conservation practices are being carried out. On some of these farms, the acreage of staple foods such as rice, beans, corn, and yautias has been increased four- to five-fold. In addition to the acreage increase, the yields per acre in many cases have doubled, farmers report, as a result of establishment of sound soil and water conservation practices.

An excellent opportunity has been afforded by the conservation program for the training of young natives in soil conservation activities through field operations, supplementing their training in agricultural colleges and other educational institutions. They have been employed by the Service and paid through Puerto Rican Reconstruction Administration, and later, Insular funds. Through their training they have been qualified to assume positions of leadership in the agricultural affairs of the Island. Many have been em-

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Soil Management For Field Beans[1]

By J. F. Davis

Michigan State College, East Lansing, Michigan

THE importance of the white pea bean in Michigan agriculture has stimulated an extensive research program in soil-management problems pertinent to the crop. Experiments with this crop have been carried on since 1921 by members of the Soil Science Department and have included studies with fertilizer analyses, methods and rate of fertilizer application, side-dressing with fertilizer during the growing season, use of green manures, farm manures, and weather conditions that affect field bean production.

Prior to 1934, the methods of applying fertilizer to field beans were four in number; namely, in contact with the seed, broadcast before planting, deep with a grain drill before planting, and plowed under. None of these methods was found to give consistent results. Often no increase in yield was found as a result of fertilization, and very often the unfertilized plots yielded equally as well or better than those which received fertilizer.

In 1934, experiments were begun in cooperation with G. A. Cumings and staff of the Bureau of Agricultural Chemistry and Engineering of the U. S. Department of Agriculture on the placement of fertilizer in bands in various locations with respect to the seed. The Bureau supplied the drill, since no commercial machine was available for this purpose at that time. The band method of placement refers specifically to placing the fertilizer in a band to the side of and below the seed.

Several advantages are to be derived from this type of placement. First, there is no injurious effect of the fertilizer to the germinating seed, even though rates up to 600 pounds per acre are used. Second, more efficient use of the fertilizer is obtained since the fertilizer does not come in contact with as much of the soil as when broadcast or worked in well before planting, thus preventing the fixation of the fertilizer by the soil in a form that the plants are not able to use. Third, there is a considerable saving in labor, since the planting and the application of fertilizer are completed in one operation. Fourth, by exhaustive tests the band method of placement has proved to be the most efficient and practical method to use.

Fertilizer Placement

In the beginning of this work a large number of different placements were tried out, including bands on both sides of the seed, a band under the seed, by the grain drill in which part of the fertilizer came in contact with the seed, a band on one side of the seed, and in contact with the seed. It soon became evident that placement of fertilizer in one band below and to the side of the seed was as good as any other favorable placement; and in view of the fact that it is much easier to construct a machine

[1] The material for this report is taken from an article published in the Mich. Agr. Expt. Sta. Qtr. Bul., Vol. 25, (4). May 1943.

to place the fertilizer in one band rather than two, this placement was selected as the one to recommend.

As a result of the work, not only in this State but in many other States, there are now available, in limited quantities owing to the present emergency, drills that will place the fertilizer in the way that proved, by many trials on different farms, to be the best all-around method. The results from 16 different experiments carried out on farms throughout the bean-growing area from 1934-41 are summarized in Table 1.

TABLE 1.—THE EFFECT OF FERTILIZER PLACEMENT ON THE YIELD AND STAND OF FIELD BEANS.*

Placement	Yield—bushels per acre Stand—plants per 400 feet of row	
	Yield	Stand
One side	23.8	1,416
Contact	22.4	1,093
Contact and one side	23.2	1,157
No fertilizer	21.2	1,365

* Three hundred pounds of 4-16-4 were used in the placements designated as "one side" and "contact and one side" and 75 pounds per acre with the contact treatment. The fertilizer band was located 1½ inches to the side and 1¾ inches below the seed. Therefore, in the "one side" placement, 300 pounds of fertilizer were applied in a band 1½ inches to the side of and 1¾ inches below the seed level. In the "contact and one side" placement, 225 pounds were placed in the band and 75 pounds with the seed: and with the contact treatment, 75 pounds of fertilizer were placed in contact with the seed.

The results show that whenever 75 pounds of fertilizer are placed in contact with the seed a definite injury to stand and yield results. The stand data do not fully represent all the injury to the plants, since all plants that emerged were counted and some of these plants had sufficient root injury, owing to fertilizer, so that a number of them actually never survived although they were alive at the time the stand counts were taken. In the case of the "contact and one side" placement, the fertilizer applied in the band was apparently able to counteract the stand injury to some extent, but the results were not as good as when no fertilizer was placed in contact with the seed. Therefore, it is concluded that the practice of applying fertilizers in contact with the seed even in small amounts should not be recommended.

Unless a drill that will apply fertilizer in a band to the side of and below the seed is available, none is recommended for the bean crop, because that is the only method of applying fertilizer that has given consistent increase in yield. A question arises over what a farmer can do in regard to bean fertilization if he does not have a drill that will place the fertilizer in the recommended location. In this case more fertilizer should be applied to other crops in the rotation that consistently respond to a direct application of fertilizer, such as sugar beets, small grains, and alfalfa, rather than to the beans by a method of application that cannot be depended upon to give favorable results. Possibly a neighbor has a drill that will place the fertilizer properly, and arrangements might be made to obtain its use.

Note that the average increase in yield of beans for the 16 experiments is 2.6 bushels, which is not very great and during periods of low prices not always profitable. Large increases in the yield of beans resulting from direct applications of fertilizer are not as a

TABLE 2.—THE EFFECT OF RATES OF APPLICATION OF FERTILIZER ON THE YIELD OF FIELD BEANS.*

Pounds per acre	Yield—bushels per acre
200	23.2
400	24.5
600	25.7
No fertilizer	20.6

* Average of 11 experiments. 4-16-4 fertilizer was used in the experiments and applied in bands to the side of and below the seed.

TABLE 3.—THE EFFECT OF FERTILIZER ANALYSES ON THE YIELD OF FIELD BEANS ON THE FERDEN FARM, 1934–42.

Fertilizer*	1934	1935	1936	1937	1938	1939	1940	1942	Average
0–20–0	25.4	35.1	29.1	31.2	37.0	19.0	27.3	15.4	27.4
0–16–8	27.1	35.4	28.8	33.3	39.8	19.5	28.8	17.7	28.8
4–16–8	27.9	38.4	26.5	34.3	37.9	19.8	28.5	22.3	29.5
4–16–4	27.6	37.5	29.7	32.9	37.7	19.1	30.2	21.3	29.5
No fertilizer	24.5	35.2	25.1	26.1	32.2	16.6	24.6	11.8	24.0

* All analyses except the 0-20-0 were applied at the rate of 150 pounds per acre; 120 pounds per acre of 0-20-0 were used. The fertilizers were applied in a band to the side and below the seed, the approved method of placement. Yields were not obtained in 1941, owing to the blowing of some of the piles of beans from one plot to another before it was possible to put the beans up on stakes.

rule obtained. However, with a favorable price level and with the proper method of application, the use of commercial fertilizer on beans, on the average, will prove to be a profitable venture.

A pertinent question arises at this point. What is the best rate to apply fertilizer per acre? The average yields per acre in 11 different experiments show that the most practical rate per acre was 200 pounds, provided the fertilizer is applied in the proper manner.

On one farm in Saginaw County experiments with different fertilizer analyses have been conducted since 1934. The rotation consists of beans, oats, and wheat, with sweet clover seeded in the wheat to provide a green manure crop to plow down for the beans. The results are recorded in Table 3.

The data indicate that fertilizer containing both phosphorus and potash was the best on the average for the beans. During two years out of the eight, 1935 and 1942, the yields from plots receiving the 4-16-8 fertilizer were higher than yields of plots fertilized with the 0-16-8. However, in 1936 and 1938, the reverse of this was true. Owing to the fact that the yields from the two treatments vary from year to year, the average increase in yield of 0.7 bushel of the 4-16-8 fertilized plots over the 0-16-8 fertilized plots cannot be considered as a great enough margin to recommend one fertilizer over another. The plots on which phosphate alone was applied did not give so high an average yield as did those treated with the other fertilizers.

Results from this farm in addition to work on other farms, not reported, have led to a general recommendation of using a fertilizer that contains phosphate and potash with a 2:1 ratio—that is, twice as many units of phosphate as potash, especially on soil not well supplied with humus.

The effect of potash on the yield of beans has been demonstrated several times. An outstanding example was found in 1939 at the Miller farm located in Clinton County. During this year a placement and analysis experiment was conducted on the farm. Only part of the field was used for the experiment. The remainder of the field was fertilized with a phosphate fertilizer. Shortly after emergence, the leaves of the plants in all rows not receiving potash turned yellow and made

TABLE 4.—THE EFFECT OF SIDE-DRESSING FIELD BEANS WITH POTASH ON THE MILLER FARM, 1939.

Treatment*	Yield—Bushels per acre
50 pounds KCl	14.7
No KCl	7.5

* Muriate of potash, 0-0-50 (KCl) was applied with a cultivator fertilizer attachment.

a poor growth. During the latter part of July some of the rows not included in the experiment but that had received the phosphate fertilizer were side-dressed with a cultivator attachment with 50 pounds of muriate of potash. A short time later, the plants appeared to have the green color restored, and the yield was virtually doubled as is shown in Table 4.

One practice, if proper precautions are taken, that has proved very beneficial in bean production is the use of leguminous green manures. The legume may be either alfalfa or sweet clover. The results from several experiments (Table 5) show that turning down a crop of sweet clover means two to six bushels more beans to the acre at a cost of the sweet clover seed,

Yield of beans at the Ferden Farm, Brookston clay loam, 1942. 1—150 lbs. per acre 0-16-0; 2—150 lbs. per acre 0-16-8; 3—150 lbs. per acre 4-16-8; 0—no fertilizer. Fertilizers applied in a band 1 inch to the side and 1¾ inches below the seed.

Sometimes the yellowing of bean leaves is considered to be the result of dry weather, when actually it is the result of potash deficiency. Results of this and other similar experiments and the fact that potash deficiency symptoms have been generally observed throughout the bean-growing area further validate the general recommendation of phosphate and potash fertilizer rather than phosphate alone. Unless one is absolutely sure that the bean crop will not respond to potash on a particular soil, it is good insurance to apply it in the fertilizer. However, care should be taken not to confuse potash deficiency symptoms with the yellowish mottling of the leaves indicating manganese deficiency.

which will probably not average more than 75 cents per acre.

In using sweet clover, one must remember to plow down the sweet clover before it exceeds nine inches in height. Too many instances have occurred where sweet clover was allowed to get too high before it was turned under, and the bean seed germinated poorly. The sweet clover had used so much of the available soil moisture that there was not sufficient remaining to germinate the bean seed. One or two experiences of this nature will cause a farmer to stop following this practice. However, this situation will not arise if the sweet clover is plowed down early enough. Results in Table 6 on the changes occurring during the early

TABLE 5.—THE EFFECT OF SWEET CLOVER GREEN MANURE ON THE YIELD OF FIELD BEANS.*

	Yield—bushels per acre				
	Horst	Dilman	Horst	Ferden	Ferden
	1935	1935	1939	1941	1942
Sweet clover plowed under	22.7	32.4	35.4	23.5	15.9
No sweet clover	20.6	26.0	32.9	21.0	13.7
Difference	2.1	6.4	2.5	2.5	2.2

* Sweet clover seeded in a small grain crop and plowed under for the beans.

growth of sweet clover are interesting.

In 1942, the roots and tops of sweet clover were harvested, and the air-dry weights taken at three different dates, April 20, April 29, and May 5. The respective heights on those dates were one, five, and nine inches. During this period the weight of the tops increased from 545 to 1,928 pounds per acre, but the roots decreased in weight from 1,177 pounds to 977 pounds. The total gain in weight was 1,183 pounds. However, the per cent nitrogen progressively decreased from 4.6 to 3.5 in the tops and from 3.6 to 2.2 in the roots. Thus, the total change in nitrogen content was not so great as indicated by the increase in top growth. During the time of the experiment, while the amount of nitrogen in the tops increased, the nitrogen in the roots was decreasing. From April 29 to May 5, the total amount of nitrogen in both tops and roots increased only 6.7 pounds, although the height of the plants was virtually doubled. These results point out that some of the increase in top growth is actually at the expense of the root reserve material. Sweet clover plowed early will not deplete the moisture supply unduly and at the same time will provide a better quality of green manure, higher in percentage of nitrogen and more effective in the soil.

One of the difficulties involved in the problems of soil management in regard to the bean crop is the inconsistency of results obtained on the same farm from year to year. There often occurs the situation where fertilizer applied properly gives a favorable increase in the early growth of the plant that persists up until the blooming period. However, at harvest time there is little if any difference in the yield of the fertilized plots and those not receiving fertilizer. Apparently something happened during the blooming period to prevent the early advantage in growth

TABLE 6.—CHANGES OCCURRING DURING THE EARLY GROWTH OF SWEET CLOVER, BROOKSTON CLAY LOAM.

Date	Height	Pounds per acre*			Per cent Nitrogen		Pounds Nitrogen per acre		
	Tops	Tops	Roots	Total	Tops	Roots	Tops	Roots	Total
Apr. 20	1″	545	1,177	1,722	4.6	3.6	24.9	42.8	67.7
Apr. 29	5″	1,373	1,123	2,496	3.7	2.8	50.5	31.3	81.8
May 5	9″	1,928	977	2,905	3.5	2.2	67.0	21.5	88.5

* Weight refers to air-dry material.

TABLE 7.—THE SEASONAL EFFECT OF FERTILIZERS ON THE YIELD OF FIELD BEANS AT THE MILLER FARM, 1939–41.

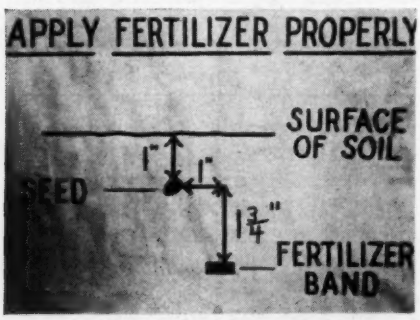
Treatment*	Yield—bushels per acre		
	1939	1940	1941
0–16–8.....	14.1	21.9	24.8
No fertilizer...	8.6	23.0	21.0
Difference.....	5.5	−1.1	3.8

* The fertilizer was applied at the rate of 300 pounds per acre in a band to the side and below the seed.

due to the fertilizer from being reflected in higher yields. For example in Table 7 are found the yields of beans on the same farm for 1939, 1940, 1941.

In 1939, fertilizer increased the yield 5.5 bushels. However, in 1940, the yield from fertilized plots was actually less than from plots receiving no fertilizer. Again in 1941, the yield was increased by 3.8 bushels from the same fertilizer treatment. Why the inconsistency of results? Here is a typical example of what sometimes happens when fertilizer is applied for beans. The fact that the best bean-producing area in the State is located in the Saginaw Bay area, although other areas in the State have equally as fertile soils, leads one to believe that climatic factors are important in bean production.

The fact that hot, dry winds during the blooming period have long been associated with blasting of the blossoms,



Fertilizer for beans should be applied in a band to the side and below the seed as indicated by this chart.

thus preventing pod formation, would indicate that temperature had a great effect on the yield of the crop. Therefore, even though an increase in the growth of the plant resulted from a fertilizer application, unless favorable weather conditions prevailed during the time the pods were forming, this favorable early response in growth would not necessarily be reflected by an increased yield of the crop.

In an attempt to explain why the yield of the crop is not reduced in proportion, even though fertilizer placed in contact with the seed seriously injures germination, beans were planted in rows and then thinned to the distances shown in Table 8. The results show that the distance between plants

TABLE 8.—THE EFFECT OF SPACING ON THE YIELD OF FIELD BEANS.

Spacing*	Yield—Bushels per acre	Spacing*	Yield—Bushels per acre
16 inch....	19.5	4 inch.....	22.8
8 inch....	22.7	3 inch.....	22.3
5 inch....	23.8	2½ inch...	22.8

* Refers to distance between plants in the row.

in the row had little effect on the yield until the extreme of 16 inches between plants is reached. Therefore, although a contact application of fertilizer injured the stand, often there are sufficient plants left so that the yield is not reduced in proportion to the stand injury. However, in stands of beans that have suffered injury from fertilizer, the stand is not always affected in a regular manner, but possibly all plants are killed for a space of three feet or more and then a nearly normal stand may occur for the next few feet. Thus, even though the spacing has little effect on yield, the fact that injury to germination causes an irregular stand results in a decrease in yield.

1. Fertilizers for field beans should be applied in a band approximately 1

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Oats and lespedeza are important crops on "Lucky City" farms.

"Lucky City"

By F. J. Hurst

Administrative Assistant, Agricultural Adjustment Agency, Jackson, Mississippi

WITH all sorts of plans being proposed for solving farm problems and remaking the post-war world, it might be a good idea to take a close-up look at a farm community that is doing an excellent job of building richer lands, better homes, and finer citizens while growing food and fiber in abundance for a hungry world.

This is the story of a farm community that knows there are no substitutes for wise planning, correct information, hard work, and personal thrift.

It is the story of a farm community of comfortable homes, productive farms, big red barns, well-fenced fields, improved pastures, splendid dairy herds and poultry flocks, good gardens, and full pantries.

It is the story of a rural community whose farm families have provided all of these good things by their own toil and thrift. Not a dollar of relief money has ever been spent in this neighborhood. Every month new money comes in from the marketing of chickens and eggs, milk and cream.

It is the story of Gluckstadt in Madison County, Mississippi. Gluckstadt in German means "Lucky City." The people of Gluckstadt say they are lucky because Gluckstadt is not located in Germany, but in freedom-loving America.

Gluckstadt was established 37 years ago when three German families—the Schmidts, the Kehles, and the Klaases —bought small farms and built modest

homes there. Since that time these original farms have been enlarged and improved, and today 13 more German families live within the "Lucky City."

All are loyal citizens. Each of these 16 families is doing its best to help defeat the Axis powers. They are producing Food for Freedom. They have sons who are fighting with the nation's armed forces and working in their country's war plants. They are donating scrap metal for building ships and planes, guns and tanks, and are buying war bonds to help pay for them.

Typical of the community is the story of Mr. and Mrs. Matt Schmidt, except that they have nine boys and no girls. Thirty-seven years ago they bought 80 acres of abandoned and unimproved land and built a small home. They now own 434 acres. Every acre has been improved and is producing far more than it yielded 37 years ago. The Schmidts cultivate nearly 400 acres of land, milk a fine herd of Jersey cows, keep a flock of white leghorn hens, produce around 50 bales of cotton, and raise plenty of good things to eat.

Patriotic Americans

When the family outgrew the original home, the Schmidts built a modern two-story home and equipped it with all necessary conveniences. They now have a modern dairy barn, mule barn, silo, tool sheds, workshop, concrete drinking troughs, and labor-saving machinery.

When Fred and Herbert were inducted into the armed forces, Henry went to work at a war plant at Laurel and Arthur in Jackson, Mr. and Mrs. Schmidt and the other boys not only carried on but actually stepped-up production. They bought a milking machine and added more cows to the dairy herd. They increased the size of the poultry flock, brooded more chicks and sold more eggs. They bought another combine and raised and harvested more oats.

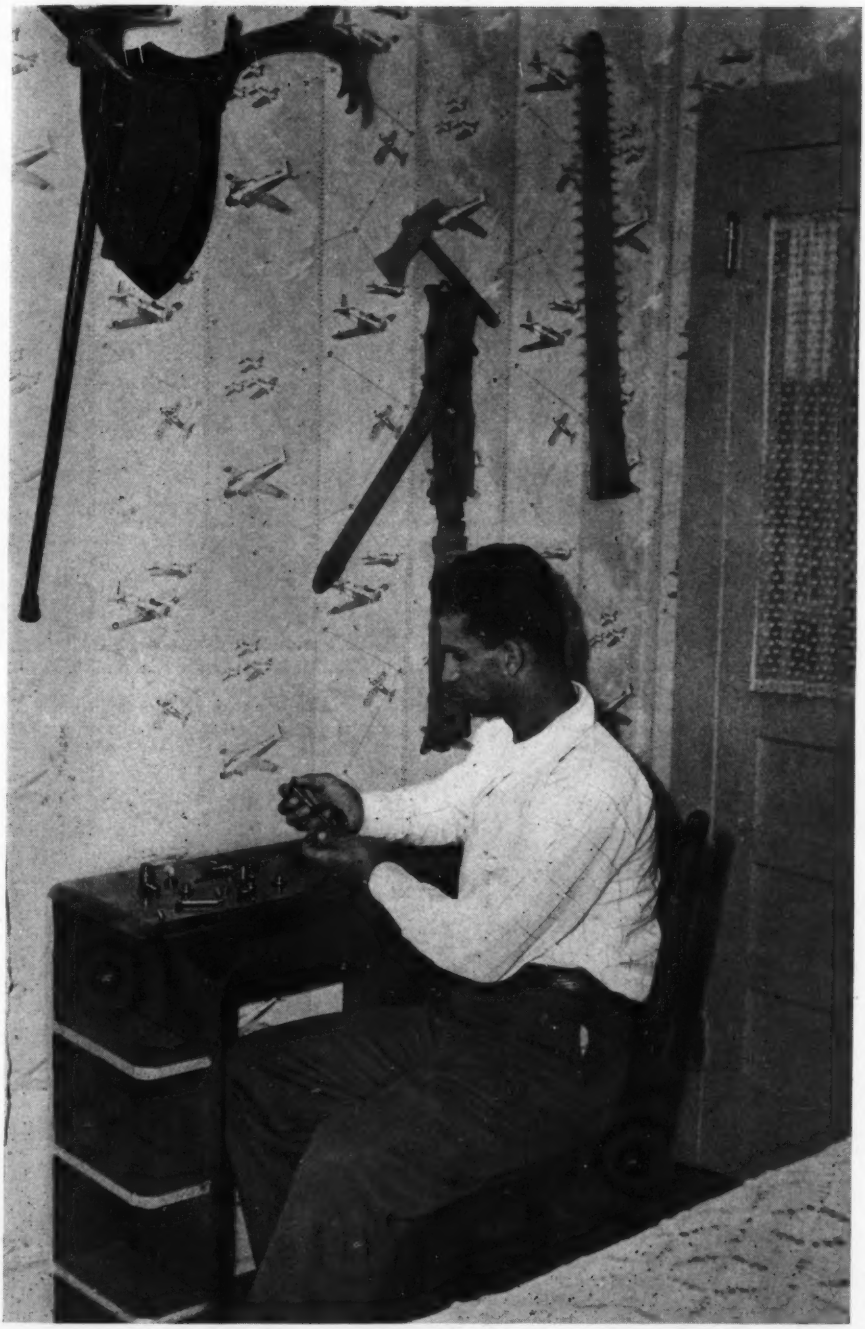
Mr. and Mrs. Schmidt visited Fred and Herbert at Camp Polk, Louisiana, before they were sent on maneuvers in California. She said, "They like Army life. They find it interesting and educational." But the thing that impressed her most was the religious services held in the camp chapel. Mrs. Schmidt said, "It's wonderful how our boys in the armed services pray. It puts some of the people at home to shame."

It's an inspiration to listen to John Kehle, one of the original settlers of "Lucky City," now over 70, tell how he started farming on land impoverished by one-crop farming and erosion, covered with stumps, and marred by gullies. One by one, at first with pick and shovel, later with dynamite, the stumps were all dug or blasted and the gullies filled in, so that today the combine and mowing machine can be safely operated on every acre of crop and pasture land on the farm. There were no fences, no buildings except a few dilapidated cabins. Mr. Kehle planned his own home, sawed his own timber into lumber, and built his own lovely home, commodious barn, and other buildings.

Mr. Kehle has one son, Alphonse, in the Air Corps. Eugene, who stayed at home to operate the farm, has stepped up production by increasing the size of the dairy herd and poultry flock, and selling more milk and eggs. Eugene is probably Mississippi's most efficient farmer. With the help of only one negro laborer he is cultivating 203 acres of land, milking 31 cows, and tending a flock of 300 hens. He has 86 acres of oats and lespedeza, 15 acres lespedeza alone, 50 acres in corn, 15 acres in soybeans for oil, 15 acres in cowpeas, 2 acres in Irish potatoes, and 20 acres in cotton. There are 150 acres in improved pasture.

Last year he had 21 acres in cotton, but this year he cut it to 20 because he "could not get any help." Although he has only two acres in Irish potatoes,

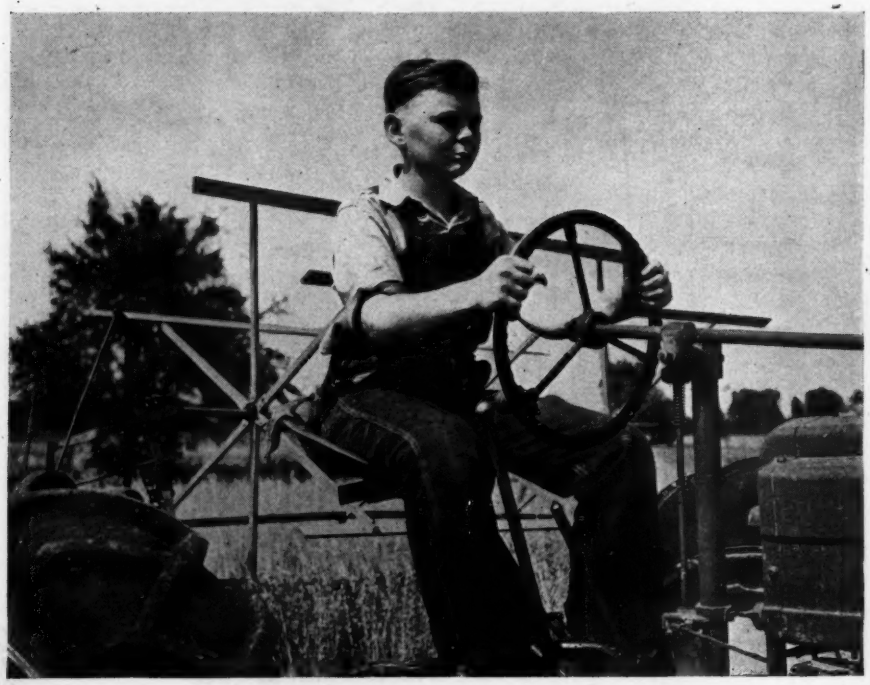
(*Turn to page* 48)



Bobby Klaas, 19-year-old "Lucky City" farm boy, shows the micrometer he used in making war planes. He left his employment in an aircraft factory at New Britain, Connecticut, where he worked 12 hours a day, in eight weeks won the Army's E for excellence, and was receiving a salary of $81 a week, to enlist in the U. S. Army Air Corps.

Above: Eugene Kehle, one of Mississippi's top farmers, loves the farm and farm work.

Below: Matt Schmidt, Jr., 13 years old, makes a "full" hand in driving the tractor.



Above: Mrs. Schmidt, mother of nine fine boys, is an excellent cook and homemaker.

Below: Henry Klaas has one of the best-equipped farm shops in "Lucky City" community.

Above: The Tony Klaas home is tastefully furnished and equipped with modern conveniences.

Below: The future dairy herd on the Kehle farm gives promise of continued prosperity.

The Editors Talk

Increasing Ammunition

It now is recognized generally that food is just as much an ammunition for victory as the munitions which are pouring from our factories. It will be recognized when American food production goals for 1944 are fully publicized that the greatest food production job in all history is being placed in the lap of the American farmer.

What is he going to do about it? Does he have more acres to plow under? That will involve more labor and more equipment, both of which are present problems of serious proportions. Can he make the acres now in production yield more? Dr. George D. Scarseth, Soil Chemist of the Purdue University Agricultural Experiment Station and Head of the University's Department of Agronomy, emphatically says, "Yes!"

Citing Indiana as an example, Dr. Scarseth declares that if Hoosier farmlands now under cultivation were brought up to the ultimate levels of fertility made possible by soil chemistry research and experimentation, they could be made to produce 82,000,000 more bushels of corn, 32,000,000 more bushels of wheat, oats, barley, and soybeans, and 800,000 more tons of tomatoes annually—and all this without plowing up a single additional acre. "Then think," he says, "what it would mean if every other farm state could follow suit and increase the fertility of its fields with nitrogen, phosphorus, potash, and lime and make the best use of modern machinery and methods for spreading these vital elements out upon the soil in proper rotation and getting them into the earth with utmost efficiency so that the growing crops would derive maximum benefits."

Dr. Scarseth believes that the realization of this dream could not be accomplished until after the war because of the time it would take to teach farmers to regard agriculture as a "manufacturing" rather than a "mining" process and because of the war restrictions on certain fertilizer elements. However, the "know how" is readily available to farmers via their official agricultural advisers and much can be done toward increasing soil fertility and yield per acre with current supplies of plant food if farmers will take advantage of this "know how."

Included in the "know how" of efficient fertilization is the use of a proper ratio or balance of plant foods for the various crops on different soils as determined by the many years of agronomic and experimental work expended to gain this knowledge. Research workers are agreed that in most instances it is far more advantageous to maintain the correct ratio of plant foods for the particular crop, adjusting the rate of application to supply, than it is to disturb the balance by lowering the content of some element. As in humans, deficiency symptoms show up in plants and yield and quality suffer when diets are disturbed.

Plowing up additional acres merely would serve to aggravate existing fertilizer, farm labor, and machinery supply problems and add to the Nation's vast expanses of "starving" farmlands after the war. Holding to established ratios

on established acres and employing the many other factors of the "know how" of fertilizer use, such as methods and time of application, will be one very important means of increasing our food ammunition in 1944.

The Farmer's Postwar Plan

As the war progresses favorably for the Allies, public attention is drawn more and more to postwar planning. The problems are tremendous and global in their significance, but it is safe to say that each individual is trying also to interpret this significance in terms of his own welfare.

It was important, therefore, to have Chris L. Christensen, former Dean of the College of Agriculture, University of Wisconsin, recently speak in terms of the American farmer.

"In planning for postwar agriculture," Dr. Christensen said, "we should aim to assure every reasonably efficient American farmer an acceptable American standard of living. On first thought that goal may sound selfish. Actually it is not, for rural people are entitled to a fair return on the capital and labor they invest. And even more important, it is to the advantage of the whole nation to give farming an economic soundness that will attract and hold our best rural citizenry on the land.

"One of the biggest problems in agriculture has been the belief that anyone can farm. Frankly, I have never liked this idea," he said. "The future of farming and of producing food for the Nation depends on a recognition that farming is a skilled occupation. It can be kept skilled by rewarding skill. We should not inflict subsidized competition on self-supporting rural people."

Dr. Christensen set as three conditions which must exist before the large share of our farming will be on a good basis, the following:

I. Fairly full employment in industry;

II. A recapture, in some measure, of our foreign agricultural markets;

III. A stepping-up of research and education in agriculture.

Unless those objectives can be attained, he sees no alternative but a decline in the importance of agriculture, a reduction of its contribution to national life, a continuation of agricultural relief, or a combination of the three. He believes those answers are not acceptable to a free and independent people.

The Eleventh Commandment

Thou shalt inherit the holy earth as a faithful steward, conserving its resources and productivity from generation to generation. Thou shalt safeguard thy fields from soil erosion, thy living waters from drying up, thy forests from desolation, and protect thy hills from overgrazing by thy herds, that thy descendants may have abundance forever. If any shall fail in this stewardship of the land, thy fruitful fields shall become sterile stony ground and wasting gullies, and thy descendants shall decrease and live in poverty or perish from off the face of the earth.

Dr. W. C. Lowdermilk

Farm Prices of Farm Products*

	Cotton Cents per lb.	Tobacco Cents per lb.	Potatoes Cents per bu.	Sweet Potatoes Cents per bu.	Corn Cents per bu.	Wheat Cents per bu.	Hay Dollars per ton	Cottonseed Dollars per ton	Truck Crops
1910–14 Average	12.4	10.4	69.6	87.6	64.8	88.0	11.94	21.59	....
1920	32.1	17.3	249.5	175.7	144.2	224.1	21.26	51.73	....
1921	12.3	19.5	103.8	118.7	58.7	119.0	12.96	22.18	....
1922	18.9	22.8	96.7	104.8	58.5	103.2	11.68	35.04	....
1923	26.7	19.0	84.1	104.4	80.1	98.9	12.29	43.69	....
1924	27.6	19.0	87.0	137.0	91.2	110.5	13.28	38.34	....
1925	22.1	16.8	113.9	171.6	99.9	151.0	12.54	35.07	....
1926	15.1	17.9	185.7	156.3	69.9	135.1	13.06	27.20	....
1927	15.9	20.7	132.3	114.0	78.8	120.5	12.00	28.56	....
1928	18.6	20.0	82.9	112.3	89.1	113.4	10.63	37.70	....
1929	17.7	18.6	93.7	118.4	87.6	102.7	11.56	34.98	....
1930	12.4	12.9	124.4	115.8	78.0	80.9	11.31	26.25	....
1931	7.6	8.2	72.7	92.9	49.8	48.8	9.76	17.04	....
1932	5.8	10.5	43.3	57.2	28.1	38.8	7 53	9.74	....
1933	8.1	12.9	66.0	59.4	36.5	58.1	6.81	12.32	....
1934	12.0	17.1	68.0	79.1	61.3	79.8	10.67	26.12	....
1935	11.6	16.1	49.4	73.9	77.4	86.4	10.57	35.56	....
1936	11.7	17.2	99.6	85.3	76.7	96.0	8.93	31.78	....
1937	11.1	19.9	88.3	91.8	94.8	107.1	10.36	30.24	....
1938	8.3	17.2	55.5	76.9	49.0	66.1	7.55	21.13	....
1939	8.7	13.6	68.1	75.4	47.6	63.6	6.95	22.17	....
1940	9.6	15.1	70.7	85.2	59.0	73.9	7.62	24.31	....
1941	13.3	19.1	64.6	94.4	64.3	84.0	8.10	35.04	....
1942	18.51	28.3	110.0	108.3	79.5	101.8	10.05	44.42	....
September	18.59	36.8	107.7	120.5	82.6	102.8	9.03	45.33	....
October	18.87	42.3	102.5	107.9	77.5	103.5	9.39	46.46	....
November	19.22	39.8	108.4	103.5	75.9	104.4	9.84	45.01	....
December	19.55	40.0	111.8	110.3	80.2	110.3	10.46	44.72	....
1943									
January	19.74	35.1	117.8	121.4	88.0	117.5	11.20	44.34	....
February	19.68	18.2	125.7	129.8	90.4	119.5	11.94	44.88	....
March	19.91	16.0	145.1	153.6	94.8	122.7	12.28	45.73	....
April	20.13	16.0	166.8	179.2	100.2	122.3	12.61	45.89	....
May	20.09	37.6	190.7	225.1	103.4	122.8	12.66	46.11	....
June	19.96	57.0	188.0	222.0	106.0	124.0	12.20	46.40	....
July	19.60	59.0	167.0	267.0	108.0	126.0	11.90	44.50	....
August	19.81	38.4	159.0	276.0	109.0	127.0	12.20	50.90	....
September	20.20	37.2	134.0	231.0	109.0	130.0	12.90	51.90	....

Index Numbers (1910-14 = 100)

1920	259	166	358	201	223	255	178	240	....
1921	99	187	149	136	91	135	109	103	....
1922	152	219	139	120	90	117	98	162	....
1923	215	183	121	119	124	112	103	202	....
1924	223	183	125	156	141	126	111	177	150
1925	178	161	164	196	154	172	105	162	153
1926	122	172	267	178	108	154	109	126	143
1927	128	199	190	130	122	137	101	132	121
1928	150	192	119	128	138	129	89	175	159
1929	143	179	135	135	135	117	97	162	149
1930	100	124	179	132	120	92	95	122	140
1931	61	79	104	106	77	55	82	79	117
1932	47	101	62	65	43	44	63	45	102
1933	65	124	95	68	56	66	57	57	105
1934	97	164	98	90	95	91	89	121	104
1935	94	155	71	84	119	98	89	165	126
1936	94	165	143	97	118	109	75	147	113
1937	90	191	127	105	146	122	87	140	122
1938	67	165	80	88	76	75	63	98	101
1939	70	131	98	86	73	72	58	103	109
1940	78	145	102	97	91	84	64	126	121
1941	107	184	93	108	99	95	68	162	145
1942	149	272	158	124	123	116	84	206	199
September	150	338	155	138	127	117	76	210	191
October	152	407	147	123	120	118	79	215	226
November	155	383	156	118	117	119	82	208	238
December	158	385	161	126	124	125	88	207	293
1943									
January	159	338	169	139	136	134	94	205	277
February	159	175	181	148	140	136	100	208	301
March	161	154	208	175	146	139	103	212	302
April	162	154	240	205	155	139	106	213	291
May	162	362	274	257	160	140	106	214	253
June	161	548	270	253	164	141	102	215	308
July	158	567	240	305	167	143	100	206	315
August	160	369	228	315	168	144	102	236	308
September	163	358	193	264	168	148	108	240	311

Wholesale Prices of Ammoniates

	Nitrate of soda per unit N bulk	Sulphate of ammonia bulk per unit N	Cottonseed meal S. E. Mills per unit N	Fish scrap, dried 11-12% ammonia, 15% bone phosphate, f.o.b. factory, bulk per unit N	Fish scrap, wet acidulated, 6% ammonia, 3% bone phosphate, f.o.b. factory, bulk per unit N	Tankage 11% ammonia, 15% bone phosphate, f.o.b. Chicago, bulk, per unit N	High grade ground blood, 16-17% ammonia, Chicago, bulk, per unit N
1910–14	$2.68	$2.85	$3.50	$3.53	$3.05	$3.37	$3.52
1922	3.04	2.58	6.07	4.66	3.54	4.75	4.99
1923	3.02	2.90	6.19	4.83	4.25	4.59	5.16
1924	2.99	2.44	5.87	5.02	4.41	3.60	4.25
1925	3.11	2.47	5.41	5.34	4.71	3.97	4.75
1926	3.06	2.41	4.40	4.95	4.15	4.36	4.90
1927	3.01	2.26	5.07	5.87	4.35	4.32	5.70
1928	2.67	2.30	7.06	6.63	5.28	4.92	6.00
1929	2.57	2.04	5.64	5.00	4.69	4.61	5.72
1930	2.47	1.81	4.78	4.96	4.15	3.79	4.58
1931	2.34	1.46	3.10	3.95	3.33	2.11	2.46
1932	1.87	1.04	2.18	2.18	1.82	1.21	1.36
1933	1.52	1.12	2.95	2.86	2.58	2.06	2.46
1934	1.52	1.20	4.46	3.15	2.84	2.67	3.27
1935	1.47	1.15	4.59	3.10	2.65	3.06	3.65
1936	1.53	1.23	4.17	3.42	2.67	3.58	4.25
1937	1.63	1.32	4.91	4.66	3.65	4.04	4.30
1938	1.69	1.38	3.69	3.76	3.17	3.15	3.53
1939	1.69	1.35	4.02	4.41	3.12	3.87	3.90
1940	1.69	1.36	4.64	4.36	3.35	3.33	3.39
1941	1.69	1.41	5.50	5.32	3.27	3.76	4.43
1942	1.74	1.41	6.11	5.77	3.34	5.04	6.76
September	1.75	1.42	5.69	5.77	3.34	4.86	6.97
October	1.75	1.42	5.72	5.77	3.34	4.86	6.80
November	1.75	1.42	6.06	5.77	3.34	4.86	6.53
December	1.75	1.42	5.68	5.77	3.34	4.86	6.53
1943							
January	1.75	1.42	5.68	5.77	3.34	4.86	6.53
February	1.75	1.42	5.83	5.77	3.34	4.86	6.53
March	1.75	1.42	6.30	5.77	3.34	4.86	6.53
April	1.75	1.42	6.29	5.77	3.34	4.86	6.53
May	1.75	1.42	6.29	5.77	3.34	4.86	6.53
June	1.75	1.42	6.30	5.77	3.34	4.86	6.53
July	1.75	1.42	6.30	5.77	3.34	4.86	6.71
August	1.75	1.42	6.30	5.77	3.34	4.86	6.71
September	1.75	1.42	6.30	5.77	3.34	4.86	6.71

Index Numbers (1910-14 = 100)

1922	113	90	173	132	117	140	142
1923	112	102	177	137	140	136	147
1924	111	86	168	142	145	107	121
1925	115	87	155	151	155	117	135
1926	113	84	126	140	136	129	139
1927	112	79	145	166	143	128	162
1928	100	81	202	188	173	146	170
1929	96	72	161	142	154	137	162
1930	92	64	137	141	136	112	130
1931	88	51	89	112	109	63	70
1932	71	36	62	62	60	36	39
1933	59	39	84	81	85	97	71
1934	59	42	127	89	93	79	93
1935	57	40	131	88	87	91	104
1936	59	43	119	97	89	106	121
1937	61	46	140	132	120	120	122
1938	63	48	105	106	104	93	100
1939	63	47	115	125	102	115	111
1940	63	48	133	124	110	99	96
1941	63	49	157	151	107	112	126
1942	65	49	175	163	110	150	192
September	65	50	163	163	110	144	198
October	65	50	163	163	110	144	193
November	65	50	173	163	110	144	186
December	65	50	162	163	110	144	186
1943							
January	65	50	162	163	110	144	186
February	65	50	167	163	110	144	186
March	65	50	180	163	110	144	186
April	65	50	180	163	110	144	186
May	65	50	180	163	110	144	186
June	65	50	180	163	110	144	186
July	65	50	180	163	110	144	191
August	65	50	180	163	110	144	191
September	65	50	180	163	110	144	191

Wholesale Prices of Phosphates and Potash**

	Superphosphate Baltimore, per unit	Florida land pebble, 68% f.o.b. mines, bulk, per ton	Tennessee phosphate rock, 75% f.o.b. mines, bulk, per ton	Muriate of potash bulk, per unit, c.i.f. Atlantic and Gulf ports	Sulphate of potash in bags, per unit, c.i.f. Atlantic and Gulf ports	Sulphate of potash magnesia, per ton, c.i.f. Atlantic and Gulf ports	Manure salts bulk, per unit, c.i.f. Atlantic and Gulf ports	Kainit, 20% bulk, per unit, c.i.f. Atlantic and Gulf ports
1910–14	$0.536	$3.61	$4.88	$0.714	$0.953	$24.18	$0.657	$0.655
1922	.566	3.12	6.90	.632	.904	23.87	....	.508
1923	.550	3.08	7.50	.588	.836	23.32	....	.474
1924	.502	2.31	6.60	.582	.860	23.72	....	.472
1925	.600	2.44	6.16	.584	.860	23.72	....	.483
1926	.598	3.20	5.57	.596	.854	23.58	.537	.524
1927	.535	3.09	5.50	.646	.924	25.55	.586	.581
1928	.580	3.12	5.50	.669	.957	26.46	.607	.602
1929	.609	3.18	5.50	.672	.962	26.59	.610	.605
1930	.542	3.18	5.50	.681	.973	26.92	.618	.612
1931	.485	3.18	5.50	.681	.973	26.92	.618	.612
1932	.458	3.18	5.50	.681	.963	26.90	.618	.591
1933	.434	3.11	5.50	.662	.864	25.10	.601	.565
1934	.487	3.14	5.67	.486	.751	22.49	.483	.471
1935	.492	3.30	5.69	.415	.684	21.44	.444	.488
1936	.476	1.85	5.50	.464	.708	22.94	.505	.560
1937	.510	1.85	5.50	.508	.757	24.70	.556	.607
1938	.492	1.85	5.50	.523	.774	25.17	.572	.623
1939	.478	1.90	5.50	.521	.751	24.52	.570	.607
1940	.516	1.90	5.50	.517	.730	....	.573	....
1941	.547	1.94	5.64	.522	.748	25.55	.570	....
1942	.600	2.13	6.29	.522	.748	25.74	.205	....
September	.600	2.20	6.50	.503	.755	26.00	.197	....
October	.600	2.10	6.20	.535	.755	26.00	.210	....
November	.600	2.00	5.90	.535	.755	26.00	.210	....
December	.600	2.00	5.90	.535	.755	26.00	.210	....
1943								
January	.600	2.00	5.90	.535	.755	26.00	.210	....
February	.600	2.00	5.90	.535	.755	26.00	.210	....
March	.608	2.00	5.90	.535	.755	26.00	.210	....
April	.640	2.00	5.90	.535	.755	26.00	.210	....
May	.640	2.00	5.90	.535	.755	26.00	.210	....
June	.640	2.00	5.90	.471	.665	22.88	.176	....
July	.640	2.00	5.90	.503	.755	26.00	.188	....
August	.640	2.00	5.90	.503	.755	26.00	.188	....
September	.640	2.00	5.90	.503	.755	26.00	.188	....

Index Numbers (1910-14 = 100)

1922	106	87	141	89	95	99	....	78
1923	103	85	154	82	88	96	....	72
1924	94	64	135	82	90	98	....	72
1925	110	68	126	82	90	98	....	74
1926	112	88	114	83	90	98	82	80
1927	100	86	113	90	97	106	89	89
1928	108	86	113	94	100	109	92	92
1929	114	88	113	94	101	110	93	92
1930	101	88	113	95	102	111	94	93
1931	90	88	113	95	102	111	94	93
1932	85	88	113	95	101	111	94	90
1933	81	86	113	93	91	104	91	86
1934	91	87	116	68	79	93	74	72
1935	92	91	117	58	72	89	68	75
1936	89	51	113	65	74	95	77	85
1937	95	51	113	71	79	102	85	93
1938	92	51	113	73	81	104	87	95
1939	89	53	113	73	79	101	87	93
1940	96	53	113	72	77	....	87	....
1941	102	54	116	73	78	106	87	....
1942	112	59	129	73	78	106	84	....
September	112	61	133	70	79	108	83	....
October	112	58	127	75	79	108	85	....
November	112	55	121	75	79	108	85	....
December	112	55	121	75	79	108	85	....
1943								
January	112	55	121	75	79	108	85	....
February	112	55	121	75	79	108	85	....
March	113	55	121	75	79	108	85	....
April	119	55	121	75	79	108	85	....
May	119	55	121	75	79	108	85	....
June	119	55	121	66	70	95	80	....
July	119	55	121	70	79	108	82	....
August	119	55	121	70	79	108	82	....
September	119	55	121	70	79	108	82	....

Combined Index Numbers of Prices of Fertilizer Materials, Farm Products and All Commodities

	Farm prices*	Prices paid by farmers for commodities bought*	Wholesale prices of all commodities†	Fertilizer materials‡	Chemical ammoniates	Organic ammoniates	Superphosphate	Potash
1922.....	132	149	141	116	101	145	106	85
1923.....	142	152	147	114	107	144	103	79
1924.....	143	152	143	103	97	125	94	79
1925.....	156	157	151	112	100	131	109	80
1926.....	145	155	146	119	94	135	112	86
1927.....	139	153	139	116	89	150	100	94
1928.....	149	155	141	121	87	177	108	97
1929.....	146	153	139	114	79	146	114	97
1930.....	126	145	126	105	72	131	101	99
1931.....	87	124	107	83	62	83	90	99
1932.....	65	107	95	71	46	48	85	99
1933.....	70	109	96	70	45	71	81	95
1934.....	90	123	109	72	47	90	91	72
1935.....	108	125	117	70	45	97	92	63
1936.....	114	124	118	73	47	107	89	69
1937.....	121	130	126	81	50	129	95	75
1938.....	95	122	115	78	52	101	92	77
1939.....	93	121	112	79	51	119	89	77
1940.....	98	122	115	80	52	114	96	77
1941.....	122	130	127	86	56	130	102	76
1942.....	157	152	144	92	57	161	112	76
September.	163	154	145	91	57	154	112	74
October...	169	155	145	92	57	154	112	78
November.	169	156	146	92	57	158	112	78
December..	178	158	147	92	57	154	112	78
1943								
January...	182	160	149	92	57	154	112	78
February..	178	162	149	92	57	155	112	78
March....	182	163	150	93	57	160	113	78
April.....	185	165	151	95	57	160	119	78
May.....	187	167	152	95	57	160	119	78
June.....	190	168	151	93	57	160	119	69
July.....	188	169	150	94	57	160	119	74
August....	193	169	150	94	57	160	119	74
September.	193	169	150	94	57	160	119	74

* U. S. D. A. figures.

† Department of Labor index converted to 1910-14 base.

‡ The Index numbers of prices of fertilizer materials are based on original study made by the Department of Agricultural Economics and Farm Management, Cornell University, Ithaca, New York. These indexes are complete since 1897. The series was revised and reweighted as of March 1940 and November 1942.

[1] Beginning with June 1941, manure salts prices are F. O. B. mines, the only basis now quoted.

** The annual average of potash prices is higher than the weighted average of prices actually paid because since 1926 better than 90% of the potash used in agriculture has been contracted for during the discount period. From 1937 on, the maximum seasonal discount has been 12%.

REVIEWS

This section contains a short review of some of the most practical and important bulletins, and lists all recent publications of the United States Department of Agriculture, the State Experiment Stations, and Canada, relating to Fertilizers, Soils, Crops, and Economics. A file of this department of BETTER CROPS WITH PLANT FOOD would provide a complete index covering all publications from these sources on the particular subjects named.

Fertilizers

"Effect of Fertilizers on Orange Yields," Agr. Exp. Sta., Univ. of Calif., Berkeley, Calif., Bul. 673, Oct. 1942, E. R. Parker and L. D. Batchelor.

"Fertilizers and Cover Crops for California Deciduous Orchards," Agr. Exp. Sta., Univ. of Calif., Berkeley, Calif., Cir 354, April 1943, E. L. Proebsting.

"Emergency Labels for Specialty Fertilizer and for Victory Garden Fertilizer 6-10-4," Dept. of Agr., State of Calif., Sacramento, Calif., FM-66, Aug. 5, 1943.

"Commercial Fertilizer Sales as Reported to Date for the Quarter Ended June 30, 1943," Dept. of Agr., State of Calif., Sacramento, Calif., FM-67, Aug. 16, 1943.

"Fertilizers for 1944—Connecticut," Agron. Department, Univ. of Conn., Storrs, Conn., Sept. 7, 1943.

"Wartime Fertilizer Recommendations for Delaware," Ext. Serv., Univ. of Del., Newark, Del., W. E. Folder No. 3 (Revised), July 1943, Claude E. Phillips and Eugene P. Brasher. . . .

"The Relation of Boron in Illinois Soils to the Growth and Boron Content of Crop Plants," Univ. of Ill., Urbana, Ill., 1943, Charles Henry Stinson.

"Fertilizer Recommendations for the Fall of 1943," Agron. Dept., Purdue Univ., Lafayette, Ind.

"All-out Fertility for Food Production," Agr. Exp. Sta., Univ. of Purdue, Lafayette, Ind., Agron. Mimeo 39, July 1943, George Scarseth and Gerald Mott.

"Cultural and Fertilizer Studies with Sweet Potatoes, Muskmelons and Watermelons on Buckner Coarse Sand," Agr. Exp. Sta., Iowa State College, Ames, Iowa, Bul. P56, June 1943, V. E. Hollar and E. S. Haber.

"Mycorrhizae and Phosphorus Nutrition of Pine Seedlings in a Prairie Soil Nursery," Agr. Exp. Sta., Iowa State College of A. & M., Ames, Iowa, Res. Bul. 314, April 1943, A. L. McComb.

"Commercial Fertilizers in Kentucky in 1942," Agr. Exp. Sta., Univ. of Ky., Lexington, Ky., Reg. Series, Bul. 34, June 1943, J. D. Turner, H. R. Allen, and Lelah Gault.

"Fertilizer Recommendations for Maine—1944," Agron. Dept., Univ. of Me., Orono, Me., Aug. 3-4, 1943.

"Fertilize Pasture and Hayland this Fall," Agr. Ext. Serv., Univ. of Me., Orono, Me., E. Cir. 184, Aug. 1943.

"Fertilizers and Their Uses for Maryland," Agr. Exp. Sta., Univ. of Md., College Park, Md., July 1943.

"Poultry Manure Its Use and Preservation," Ext. Serv., Mass. State College, Amherst, Mass., E. Leaf. 57, Revised May 1943, Ralph W. Donaldson.

"Fertilizer Recommendation for Wheat and Rye on Michigan Soils, 1943," Soil Sci. Dept., Mich. State College, East Lansing, Mich.

"County Fertilizer Data: Mixed Goods and Materials," State Dept. of Agr., Jackson, Miss., July 1, 1942 through June 30, 1943.

"Wartime Fertilizer Information," Agr. Exp. Sta., Univ. of Mo., Columbia, Mo., Bul. 474, July 1943, L. D. Haigh and W. A. Albrecht.

"Differential Growth Response of Certain Varieties of Soybeans to Varied Mineral Nutrient Condition," Agr. Exp. Sta., Univ. of Mo., Columbia, Mo., Res. Bul. 361, March 1943, Denver I. Allen.

"New Fertilizer Program for New Jersey," Agr. Exp. Sta., Rutgers Univ. New Brunswick, N. J., Cir. 471, July 1943.

"1943 Fertilizer Recommendations for Wheat, Other Fall-Sown Grains, and Permanent Pastures," Agr. Ext. Serv., Ohio State Univ., Columbus, Ohio, No. 231, Revised July 1943.

"Fertilizer Report 1942," Pa. Dept. of Agr., Harrisburg, Pa., Gen. Bul. 589, July-Aug. 1943.

"Fertilizing Pastures," Ext. Serv. Texas A. & M., College Station, Texas, MS-534, 1943, Robert R. Lancaster.

"Need and Use of Boron for Alfalfa," Agr. Exp. Sta., Burlington, Vt., Bul. 501, June 1943, D. E. Dunklee and A. R. Midgley.

"Using Borax and Boric Acid to Control House Flies in Manure," Agr. Exp. Sta., Univ. of Vt., Burlington, Vt., Pamph. No. 5, May 1943, A. R. Midgley and D. E. Dunklee.

"Va.'s Wartime Field and Truck Crop Fertilizer Recommendations from Grades Approved by the U. S. War Food Administration," Ext. Serv., Va. A. & M. College &

Poly. Inst., Blacksburg, Va., Cir. No. E-341, Revised Aug. 1943.

"Food for Victory," Agr. Ext. Serv. Va. A. & M. College & Poly. Inst., Blacksburg, Va.

"On the Farm and Home Front," Agr. Ext. Serv., W. Va. Univ., Morgantown, W. Va., Cir. WS 12 (Revised), June 1943.

"On the Farm and Home Front," Agr. Ext. Serv., W. Va. Univ., Morgantown, W. Va., Cir. WS 13, March 1943.

"Influence of Lime and Fertilizers on Pasture Establishment and Production at Jeanerette, La., 1932 to 1938," U.S.D.A., Washington, D. C., Cir. 666, May 1943, R. B. Carr and A. O. Rhoad.

"Cultural and Fertilizer Recommendations for Pecans," U.S.D.A., Washington, D. C., 1943, Max B. Hardy and James H. Hunter.

Soils

"Influence of Varied Soil Reactions on Growth and Yield of Vegetable Crops on Newtonia Silt Loam and Ruston Fine Sandy Loam Soils," Agr. Exp. Sta., Univ. of Ark., Fayetteville, Ark., Bul. 433, May 1943, Victor M. Watts and J. R. Cooper.

"Guide for the Selection of Agricultural Soils," Dept. of Agr., Ottawa, Canada, Publ. 748, F.B. 117, July 1943, P. C. Stobbe and A. Leahey.

"Soil Survey—Knox County, Indiana," U.S.D.A., Washington, D. C., Series 1934, No. 23, May 1943, H. P. Ulrich, T. M. Bushnell, D. R. Kunkel, J. S. James, R. R. Finley, E. G. Fitzpatrick, and James Thorp.

"A Study of Some Chemical and Physical Properties of the Clay Minerals Nontronite, Attapulgite and Saponite," Agr. Exp. Sta., Univ. of Mo., Columbia, Mo., Res. Bul. 354, Oct. 1942, O. G. Caldwell and C. E. Marshall.

"Mineralogical and Chemical Studies of Soil Formation from Acid and Basic Igneous Rocks in Missouri," Agr. Exp. Sta., Univ. of Mo., Columbia, Mo., Res. Bul. 359, Jan. 1943, R. P. Humbert and C. E. Marshall.

Crops

¶ The demand for fiber and the consequent desire of the Government that more hemp be grown in this country has brought forth two additional bulletins on this crop to supplement those previously reviewed. Wisconsin's Special Circular entitled, "What About Growing Hemp?" by A. H. Wright briefly covers the various points that should be considered when growing this crop. In connection with fertilization, it is brought out that soils should be fertile and that manure and commercial fertilizer usually will be needed. The fertilizers mentioned are 3-9-18 and 3-12-12 at the rate of 300 lbs. per acre. On some of the particularly fertile dark prairie soils of the State, straight superphosphate is used, and lime is advantageous on the acid soils.

¶ "Hemp," by B. B. Robinson, U. S. Department of Agriculture Farmers' Bulletin No. 1935, is one of the most complete publications that has been issued dealing with all of the factors concerned with growing, handling, and marketing the crop. This author also emphasizes the fact that hemp should not be grown on poor soil. While it is desirable that the soil be high in organic matter, peat and muck soils are not desirable owing to the low quality of fiber produced by plants growing on such soils. Local fertilizer practice is suggested in fertilizing the crop.

¶ An interesting series of investigations on forage production, particularly as related to hay, pasture, and silage, is summarized by D. S. Fink in Maine Agricultural Experiment Station Bulletin 415, entitled "Grassland Experiments." In a brief historical review of hay and pasture production in Maine, the author brings out the fact that the fertility of the soil in connection with grassland farming has usually been neglected, although in recent years there has been some attention paid to liming and the use of manure fortified with superphosphate. This is considered insufficient to maintain the fertility of the soil and in view of this country now having adequate facilities for the production of all of its fertilizer needs, it was thought desirable to investigate the results produced with more adequate attention paid to fertility levels.

Native pastures in Maine consist mostly of white clover and bluegrass. If properly handled, this pasture during the lush growth in the spring can produce excellent forage for milch cows, but usually will not carry these cows through the hot weather because of

poor growth of grasses during that period. Properly managed and fertilized native pastures, however, can carry dry cows and young stock through the entire grazing season. The author feels that only the best native pastures should be utilized, and these should be fertilized each year at the rate of about 60 lbs. each of nitrogen, phosphoric acid, and potash per acre. He suggests that about one-half acre per cow be improved in this way. These nutrients should be furnished mainly by commercial fertilizers, since animals do not like to graze after manure top-dressings. Lime should be added, of course, in accordance with the acidity of the soil. Careful data on analysis of vegetation produced, utilization by cow, losses in various ways, balanced by food fed, are given to show how the author arrived at the recommendation of about 60 lbs. of each of the plant foods mentioned above.

Improving native pasture can be done most quickly by plowing, liming, fertilizing, and seeding; but just about as good results can be obtained by top-dressing, so as to eliminate the need for plowing. It is suggested that some ladino clover be sown on top of the sod, especially if the soil is rather moist. Data are given showing that untreated areas will produce around 700 to 1,000 lbs. of milk per acre per year, while comparable areas with lime and fertilizers as suggested will produce up to 4,500 lbs.

For summer and fall pasture, hay, and at least part of the silage, ladino clover-timothy mixtures are recommended. Considerable attention is given to the growing and handling of ladino clover for these purposes. Detailed analyses of the crop indicate that it compares very favorably with other clovers, being in general higher in minerals and nitrogen and lower in fiber; in fact, the analyses of the entire ladino clover plant compared very favorably with alfalfa leaf meal. Under favorable conditions, it grows luxuriantly throughout the season and is very persistent, due to its habit of re-seeding. It is highly desirable that ladino clover be sown in combination with a grass such as timothy, rather than alone. The author points out that it does exceptionally well under rather wet conditions and can compete well with fast-growing grasses likely to be encountered under such conditions.

The author suggests that two acres of ladino-timothy mixture be maintained per cow. The first crop can be used as hay and as silage, while the after-growth produces excellent clover pasturage through the summer and fall. A system of dividing the ladino clover area into fields to fit into a forage-production program is given. Seed also can be produced from ladino clover since the second crop will be almost a pure stand of clover. A particular advantage with ladino clover in connection with seed production is that the plant is palatable and nutritious, even at seed-production stage, which is not the case with alfalfa and other clovers. Seed production is still in the experimental stage, and problems of harvesting and threshing still have to be worked out.

The heavy production of forage by ladino clover-timothy mixtures makes a heavy drain on the fertility of the soil. Balancing gains and losses of nutrients in connection with making hay and pasturing ladino clover-timothy mixtures indicates that 80 lbs. each of nitrogen, phosphoric acid, and potash per acre should be applied each year. This can be furnished by manure fortified with superphosphate, or by means of complete fertilizer. From carefully worked-out tables on the total requirements of native improved pasture and ladino clover-timothy mixtures, it is shown that 16 tons of fortified manure would be needed to take care of all the plant-food requirements. It is estimated that only 12 tons of manure per acre would be available and that each year about 70 lbs. of nitrogen and potash and 142 lbs. of phosphoric acid should be purchased to supplement the manure. It is suggested that 30 lbs. of

each of the nutrients purchased be applied on one-half acre of native pasture per cow. The remaining 40 lbs. of nitrogen and potash and 40 lbs. of phosphoric acid should be applied as a top-dressing on one-half of the oldest stand of ladino clover-timothy. One and one-half acres of ladino clover-timothy mixture should receive the 12 tons of manure supplemented with the remaining superphosphate.

All calculations are on the basis of one milch cow and would be multiplied by the number of cows in the herd. The author in his calculations uses the conventional analysis of manure as furnishing 10 lbs. each of nitrogen and potash and 5 lbs. of phosphoric acid. If the manure were not handled efficiently, the plant-food content would undoubtedly be considerably lower, and correspondingly larger amounts of fertilizer nutrients would have to be purchased.

"Plant Small Grains this Fall," Ext. Serv., Univ. of Ark., Fayetteville, Ark., Leaf. 58, 1943, Charles F. Simmons.

"Raspberry Culture," Dept. of Agr., Ottawa, Canada, Mimeo Cir., May 1943.

"Progress Report of Cooperative Potato Projects in Ontario 1942," Ontario Agr. College, Guelph, Canada.

"Better Alfalfa for Delaware," Ext. Serv., Univ. of Del., Newark, Del., Mimeo Cir. 25, August 1943, C. E. Phillips.

"Seeding Permanent Pasture," Ext. Serv., Univ. of Del., Newark, Del., Mimeo Cir. 26, August 1943, C. E. Phillips.

"Annual Report for the Fiscal Year Ending June 30, 1942," Agr. Exp. Sta., Univ. of Fla., Gainesville, Fla.

"Comparative Value of Grazing Crops for Fattening Feeder Pigs," Agr. Exp. Sta., Univ. of Fla., Gainesville, Fla., Bul. 389, June 1943, W. G. Kirk, L. O. Gratz, and V. E. Whitehurst, Jr.

"Hints for Georgia Gardeners," Agr. Ext. Serv., Univ. System of Ga., Athens, Ga., Cir. 280, Revised May 1943, Elmo Ragsdale.

"Coastal Bermuda Grass," Coastal Plain Exp. Sta., Univ. System of Ga., Tifton, Ga., Cir. 10, April 1943, Glenn W. Burton.

"Tift Sudan," Coastal Plain Exp. Sta., Univ. System of Ga., Tifton, Ga., Cir. 11, April 1943, Glenn W. Burton.

"Home Gardening in Hawaii," Agr. Exp. Sta., Univ. of Hawaii, Honolulu, Bul. 91, April 1943.

"Wartime Agricultural Research," Agr. Exp. Sta., Univ. of Idaho, Moscow, Idaho, Bul. 251, May 1943.

"Wartime Peach Production," Dept. of Agr. Ext., Purdue Univ., Lafayette, Ind., Leaf. 248, 1943, Monroe McCown.

"Pop Corn in Iowa," Agr. Exp. Sta., Iowa State College, Ames, Iowa, Bul. P54, March 1943, J. C. Eldredge and P. J. Lyerly.

"Biennial Report of the Northeast Louisiana Experiment Station 1941-42," Univ. of La., St. Joseph, La., C. B. Haddon.

"Descriptions of Apple Varieties," Agr. Exp. Sta., Mass. State College, Amherst, Mass., Bul. 403, April 1943, J. K. Shaw.

"Cultural Practices in Bearing Apple Orchards," Ext. Serv., Mass. State College, Amherst, Mass., E. Leaf. 26, Revised May 1943, J. K. Shaw.

"Soybeans—Field and Garden," Ext. Serv., Mass. State College, Amherst, Mass., E. Leaf. 90, Revised May 1943, Ralph W. Donaldson.

"Spinach Varieties," Agr. Exp. Sta., Mich. State College, East Lansing, Mich., Sp. Bul. 225 (First Revision), April 1943, Harm Drewes.

"Better Potatoes for Michigan," Ext. Div., Mich. State College, East Lansing, Mich., E. Bul. 49 (Revised), April 1943, H. C. Moore.

"Growing Barley in Michigan," Ext. Div., Mich. State College, East Lansing, Mich., E. Bul. 248, April 1943, J. W. Thayer, Jr., and E. E. Down.

"A Legume Program for Orchards on Loamy Soils," Ext. Div., Mich. State College, East Lansing, Mich., E. Bul. 249, April 1943, Carter M. Harrison and Newton L. Partridge.

"Soybeans and Soil Conservation," Agr. Exp. Sta., Univ. of Mo., Columbia, Mo., Bul. 469, May 1943, Dwight D. Smith.

"Victory Gardens for Town and City Families," Agr. Ext. Serv., Univ. of Mo., Columbia, Mo., Cir. 485, Feb. 1943, J. W. C. Anderson.

"Growing Potatoes for Home Use," Agr. Exp. Sta., Univ. of Mo., Columbia, Mo., Cir. 258, March 1943, Aubrey D. Hibbard.

"Growing Tomatoes for Home Use," Agr. Exp. Sta., Univ. of Mo., Columbia, Mo., Cir. 266, May 1943, T. J. Talbert and A. D. Hibbard.

"Seasonal Variations in the Growth and Chemical Composition of Kentucky Bluegrass," Agr. Exp. Sta., Univ. of Mo., Columbia, Mo., Res. Bul. 360, March 1943, E. Marion Brown.

"Flax A War Crop," Agr. Ext. Serv., Mont. State College, Bozeman, Mont., Cir. 131, Feb. 1943, Ralph D. Mercer.

"Dry Beans A War Crop," Agr. Ext. Serv., Mont. State College, Bozeman, Mont., Cir. 132, Feb. 1943, Ralph D. Mercer and H. E. Morris.

"Producing Dry Peas," Agr. Ext. Serv. Mont. State College, Bozeman, Mont., Cir. 136, April 1943, G. H. Bingham.

"Greater Farm Production for Nebraska," Agr. Exp. Sta., Univ. of Nebr., Lincoln, Nebr., A. R. 56th, May 1943.

"The Home Vegetable Garden," Agr. Exp. Sta., Rutgers Univ., New Brunswick, N. J., Cir. 458, April 1943, Charles H. Nissley.

"Supplementary Hay Crops," Agr. Exp. Sta., Rutgers Univ., New Brunswick, N. J., Cir. 465, May 1943, Gilbert H. Ahlgren.

"Field-Crop Experiments at the Conservancy District Substation, 1938-1942," Agr. Exp. Sta., N. M. College of Agr. & Mech. Arts, State College, N. M., Bul. 304, April 1943, Rufus Stroud.

"Fifty-Fifth Annual Report," Agr. Exp. Sta., Cornell Univ., Ithaca, N. Y., 1942.

"Growing Hay Crops and Making Quality Hay," Ext. Serv., Cornell Univ., Ithaca, N. Y., Bul. 568, Feb. 1943, George H. Serviss and H. B. Hartwig.

"Ladino Clover," Ext. Serv., Cornell Univ., Ithaca, N. Y., Bul. 569, Feb. 1943, E. Van Alstine.

"Making Silage from Hay and Pasture," Agr. Ext. Serv., Cornell Univ., Ithaca, N. Y. Bul. 570, Feb. 1943, J. K. Wilson, E. S. Savage, and G. H. Serviss.

"Legumes Help to Meet Wartime Shortages of Nitrogen and Protein," Ext. Serv., Cornell Univ., Ithaca, N. Y., Bul. 571, W. E. Bul. 75, Feb. 1943, A. F. Gustafson.

"Increasing Potato Production in 1943," Agr. Ext. Serv., Cornell Univ., Ithaca, N. Y., Bul. 572, W. E. Bul. 76, March 1943, E. V. Hardenburg.

"Vegetable Seeds for 1943," Ext. Serv., Cornell Univ., Ithaca, N. Y., Bul. 573, W. E. Bul. 77, March 1943, Paul Work.

"Growing Corn for Silage and Grain," Ext. Serv., Cornell Univ., Ithaca, N. Y., Bul. 580, W. E. Bul. 83, March 1943, S. R. Aldrich.

"Quality Hay, a Solution to Feed Shortage," Ext. Serv., Cornell Univ., Ithaca, N. Y., Bul. 596, W. E. Bul. 98, March 1943, E. S. Harrison.

"Cabbage Production," Ext. Serv., Cornell Univ., Ithaca, N. Y., Bul. 604, W. E. Bul. 105, April 1943, G. J. Raleigh.

"Techniques in Measuring Joint Relationships," Agr. Exp. Sta., N. C. State College, Raleigh, N. C., T. Bul. 74, April 1943, Walter A. Hendricks and John C. Scholl.

"Training in Horticulture," Ohio State Univ., Columbus, Ohio, Sept. 1943.

"A Brief Summary of Wheat Improvement Work in Oklahoma," Agr. Exp. Sta., Okla. A. & M. College, Stillwater, Okla., Mimeo Cir. M-100, May 1943, C. B. Cross, Hugo Graumann, and K. Starr Chester.

"Fifty-Fifth Annual Report of the South Carolina Experiment Station of Clemson Agricultural College," Agr. Exp. Sta., Clemson Agr. College, Clemson, S. C., Feb. 1943.

"Soybeans for Oil," Ext. Serv., Clemson Agr. College, Clemson, S. C., Cir. 238, April 1942, H. A. Woodle.

"Upland Rice Culture," Ext. Serv., Clemson Agr. College, Clemson, S. C., Cir. 240, May 1943, H. A. Woodle.

"South Dakota Fruit Garden," Ext. Serv., S. D. State College of Agr. & Mech. Arts, Brookings, S. D., E. Cir. 399, May 1943, Frank I. Rockwell.

"A Select List of Varieties of Fruits and Vegetables," Agr. Exp. Sta., Univ. of Tenn., Knoxville, Tenn., Cir. 84, May 1943, Brooks D. Drain.

"Plans for Summer Gardens," Agr. Ext. Serv., Univ. of Tenn., Knoxville, Tenn., Leaf. 61, June 1943.

"Tests of Vegetable Varieties for the Winter Garden Region, 1937-1941," Agr. Exp. Sta., A. & M. College of Texas, College Station, Texas, Bul. 626, Jan. 1943, Leslie R. Hawthorn.

"Bibliography and Collected Abstracts on Rubber Producing Plants," Agr. Exp. Sta., A. & M. College of Texas, College Station, Texas, Cir. 99, Nov. 1942, Alton I. Moyle.

"Pasture Demonstrations," Ext. Serv., A. & M. College of Texas, College Station, Texas, MS-574, May 1943, R. R. Lancaster.

"Annual Report 1942," Ext. Serv., Texas A. & M. College, College Station, Texas.

"Grow Your Own Protein," Ext. Serv., Va. A. & M. College and Poly. Inst., Blacksburg, Va., Cir. E. 374, June 1943.

"Pasture Guide Posts," Ext. Serv., Va. A. & M. College and Poly. Inst., Blacksburg, Va., Cir. E-375, June 1943.

"Spring Wheat for 1943," Agr. Exp. Sta., State College of Wash., Pullman, Wash., V Cir. 4, March 1943, S. P. Swenson, O. E. Barbee, O. A. Vogel, H. Jacquot, and I. M. Ingham.

"Alfalfa in Eastern Washington," Agr. Exp. Sta., State College of Wash., Pullman, Wash., V Cir. 7, March 1943, Alvin G. Law.

Economics

¶ The war requirements of the United Nations are making unprecedented demands on agricultural production in Canada. At the outbreak of the war, Canadian farmers were faced with problems of surpluses, much the same as their co-workers in the United States and many other countries of the world. The situation rapidly changed, and it is only by careful planning that Canada's large share in total agricultural production by the United Nations can be met. The agricultural situation in the Dominion and the plans that were taken for production during the current year are set forth in, "Objectives for Canadian Agriculture in 1943", issued by the

Agricultural Supplies Board of the Dominion Department of Agriculture. The foreword by the Hon. J. G. Gardiner, Dominion Minister for Agriculture, states, "It is a challenging program. It calls for larger quantities of foods than Canada has ever undertaken to produce before—particularly meats, dairy products, eggs, fresh fruits, and vegetables . . . . It is fully realized that maximum effort will be required to produce the volume of food outlined in this program—an effort that will tax the resources of every farm." Owing to the comparatively large stocks of wheat on hand, and the desire to divert acreage to other crops, a 14% decrease in acreage was planned. Large stocks of rye also were on hand and the acreage of this crop was reduced 31%. Increases in oats, barley, and hay were programmed in order to meet the needs of increased animal production in both Canada and the United States. Practically all animal and dairy products, with the exception of condensed milk, were scheduled to be increased considerably, with percentages running as high as 28%. Eggs and poultry were to be increased about the same amount. Among fruits and vegetables, potatoes were scheduled for 11% increase in acreage, while other vegetables were to be maintained or increased as possible. Field peas at present acreage and a reduction in field beans were contemplated because of large supplies on hand and no anticipation of increased demand. Large increases in acreages of sugar beets, soybeans, tobacco, and clover seeds were scheduled in order to meet anticipated increased demand for them.

"Second Annual Report, Solano County, Almond Efficiency Study, Crop Year 1942," Farm Advisor's Office, County Library Building, Fairfield, Calif.

"Valencia Production Cost Analysis Orange County 1942," Agr. Ext. Serv., Univ. of Calif., Santa Ana, Calif., Arthur Shultis and Harold E. Wahlberg.

"Fifth Annual Tokay Grape Cost Study, San Joaquin County 1942," Agr. Ext. Serv., Univ. of Calif., Berkeley, Calif., B. B. Burlingame and Clark H. Swanson.

"Statistical Information pertaining to the Marketing of Agricultural Products in Conn. 1942," State Dept. of Agr., State Office Building, Hartford, Conn., Ann Bushman and Bessie Yaffa.

"Farmers' Cooperative Associations in Florida," Agr. Exp. Sta., Gainesville, Fla., Bul. 386, May 1943, H. G. Hamilton and A. H. Spurlock.

"Labor and Material Requirements for Crops and Livestock," Agr. Exp. Sta., Gainesville, Fla., Bul. 388, June 1943, Max E. Brunk and J. Wayne Reitz.

"Problems of Beginning Farmers in Iowa," Agr. Exp. Sta., Iowa State College, Ames, Iowa, Res. Bul. 313, April 1943, J. A. Starrak.

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The Soils That Support Us

(A Book Review)

A BOOK on soils that truthfully can be designated as "not just another textbook" is "The Soils That Support Us," by Charles E. Kellogg, The Macmillan Company, New York, 1941, $3.50. While the subtitle reads "An Introduction to the Study of Soils and Their Use by Men," it is doubtful if the book would fully serve as a textbook for a technical or even introductory study of soils, owing to the general rather than specific treatment of much of the subject matter. The author presents his material in a philosophical manner, with numerous digressions into sociological relationships of soils unusual but by no means unsuited to a textbook on soils. Attention is repeatedly drawn to the effects of a certain soil, and the surrounding conditions due to or causing this soil, on the habits, traits, or economic status of the people to be found on such soil.

Practically all the subjects usually covered in conventional textbooks on soils are included but are presented in a discussional rather than descriptive or tabular form. The author's background of study and work in the field of soil classification is evident in his approach to the various subjects. Relationships of soil properties or characteristics to the origin and development of the soil are constantly emphasized.

The titles of the chapters, for the most part, are suggestive rather than descriptive. Chapter one, "In the First Place," introduces the reader to the scientific concept, the development of the interest in soils through the ages, and reasons why the soil is important to the plant. The next chapter, "The Building Material for Soils," takes up the chemical, mineralogical, and petrographic composition of soils and shows how soils begin to form as a result of geological action. The chapter on "Life and the Soil" discusses plants growing on the soil, but mainly the micro-organisms growing in the soil, and their influence on it. In the fourth chapter, "The Parts of a Soil" are considered; first, the mechanical make-up of the soil, such as texture, structure, and porosity; and then the materials in solution in the soil, with the intermediate soil colloids briefly touched on. In this chapter the important subject of the soil profile is taken up in some detail. The chapter entitled "The Rains Come and Go" discusses how the soil gets, utilizes, and disposes of the rain that falls on it, and the relationship of this and temperature to the kind of soil formed. "Soils of Little Places and of Big Places" gives the broad grouping of different kinds of soils over the world with particular emphasis on those in the United States. The next four chapters are entitled, "Soils of the Grasslands," "Soils of the Desert," "Soils of the Forested Lands (Temperate)," and "Soils of the Forested Lands (Warm and Tropical)," respectively. They take up in some detail the kinds of soils in the regions indicated in the titles, their characteristics, the reasons for their development, and their relationships to each other, with some attention to their utilization. "Men Use the Soil," the eleventh chapter, contains a general discussion of the utilization of the soil, with some attention to the economic and sociological problems involved. More specific adaptations of the general soil groups for growing the individual crops are given in "Soils for Different Crops." In chapter thirteen, "Plowing and Digging," tillage forms the subject matter. The following chapter, "Fertilizers and Lime", takes up in a general way the material indicated by the subject. "Control of Water on the Soil" makes up chapter fifteen, with a discussion of drainage, irrigation, erosion and its control, and alkali soils. "When Do Soils 'Wear Out'" is the provocative

title of chapter sixteen and brings out that the change in the fertility status of a soil for better or worse is due to management by the people on the land, sometimes impelled by forces beyond their control. When the land is abandoned for one reason or another, it will in time return to its original status as determined by the equilibrium of the soil in its environment. Some of the sociological problems involved are also brought out in this and the next chapter, "Planning the Use of the Soil." Direct and indirect planning for large regions down to communities and individual farms are discussed. The final chapter is devoted to "Soil and Our Future." This is a philosophical approach to the importance of soil in shaping peoples and their histories.

Dr. Kellogg is eminently fitted by training and position to write a book of this type. In charge of the Division of Soil Survey of the U. S. Department of Agriculture, he has had unusual opportunity to travel extensively and has at his disposal the vast fund of information on soils all over the world accumulated by the staff built up by his predecessor, Dr. C. F. Marbut, and well maintained by Dr. Kellogg. He has called on this personal and accumulated knowledge, supplemented by broad reading, to write an interesting book. It should appeal to the more mature reader, particularly the advanced college student, county agent, teacher, and agricultural adviser desiring a broader outlook than may be furnished by adhering only to one textbook on soils. It also should appeal to the reader whose acquaintanceship with the soil has been inaugurated or renewed by the ubiquitous Victory Garden and whose interest in the soil leads him in quest of further information.

Soil Management For Field Beans

(*From page* 24)

inch to the side of and 1½ to 1¾ inches below the seed. If the type of drill equipped to place the fertilizer in a band to the side of and below the seed is not available, apply no fertilizer directly to the bean crop but add the amount of fertilizer intended for the bean crop to the rate of application on other crops in the rotation, such as sugar beets, small grains, and alfalfa, that are known to respond well to fertilizer applications.

2. The generally recommended rate of fertilizer application is 150 to 300 pounds per acre.

3. Use a fertilizer containing twice as much phosphate as potash—that is, a 2:1 ratio.

4. Large increases in yields of beans from the use of commercial fertilizer are not as a rule obtained. On the average, an increase in yield of 2 to 4 bushels per acre from 150 to 300 pounds of fertilizer has been obtained provided the fertilizer is applied by the proper method of application.

5. Plow down a green manure crop for the beans. Sweet clover is an ideal crop for this purpose. However, it is important that the sweet clover be plowed down when it reaches a height of 8 or 9 inches.

6. Unfavorable climatic factors, especially during the blooming period, may be responsible for the inconsistencies of seasonal response to fertilizer applications.

7. Spacing of plants in the rows has little effect on the yield of beans until the distance between plants is greater than 8 inches.

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Meeting the Needs For the 4 F's

(*From page* 10)

other crops. For this reason even more care should be exercised in providing a good turnover of organic matter and nitrogen in the soils where these crops are grown. Even where good legume crops have been grown on the land the year previous and all the crop is harvested from the land, or the above crops follow pasture or meadow crops that have no legume crops or very poor ones growing in them and no manure is applied, it would likely be advisable to use a complete fertilizer containing nitrogen when available.

The lighter the soil, or the lower it is in organic matter or nitrogen, the higher the nitrogen content of the fertilizer should be. Possibly the fertilizer that would be best for these crops, especially on soils low or comparatively low in organic matter, would be the analysis highest in nitrogen that has been made available for use on them. For such crops grown on soils moderately low in organic matter where no legumes or only poor crops of legumes had been grown recently and very little or no manure has been applied within the last year or two, possibly the 4-10-6, 4-12-4, 4-16-4 fertilizers would be best. If, however, potash-deficiency symptoms had been definitely evident under such conditions, a 3-12-12 fertilizer would likely be best. If cotton rust had been appearing on this kind of land, a 3-9-18 fertilizer may then be advisable for this crop.

In determining the amount of fertilizer to apply, it is well to remember that a good yield of most field crops will remove the equivalent of about 100-150 lbs. of 20 per cent superphosphate from the soil annually. The higher the yield the more will be removed. This does not take into consideration that usually fixed in the soil. This may be fully half this amount. The higher the clay content of the soil, the more the soil has been leached and the lower the soil is in lime and other basic materials, the greater will be the extent of this phosphate fixation. Some of the special crops like vegetables, tobacco, cotton, etc., will also normally remove more than most of the commonly grown field crops. Since most soils are low in phosphorus, at least as much phosphate fertilizer should be applied as is removed by the crops growth. In addition to this, as much nitrogen and potash should be supplied as the condition of the soil and the deficiency symptoms of previous crops grown on the land would indicate was needed.

For instance, in a one-year rotation of small grain and lespedeza where fertilizer is applied each year, probably 100-150 lbs. annually of 0-20-0, or a mixed fertilizer containing 20 units of available phosphate would be sufficient. If, however, red or sweet clover is seeded in this small grain and fertilizer will not be used on the land again for two years, approximately double this amount should be applied. Grass and pasture crops that are usually fertilized only once in every 3 or 4 years should receive amounts that coincide as closely as possible with the frequency of application. Nitrogen and potash should, of

course, be added in addition to the phosphate, where the soil conditions, deficiency symptoms, and previous cropping would indicate they are needed.

The suggested acre rates of fertilizer for average conditions and the recommended methods of application are as follows:

Barley, wheat, or rye, 150-200 lbs. drilled in as seeded.

Oats, 100-150 lbs. drilled in at seeding time.

Corn or sorghums, 100-150 lbs. in bands ½-1 inch from seed and 1-2 inches deep.

Alfalfa, 250-300 lbs. drilled when seeded, or in old stands.

Clovers and lespedeza, maximum amounts recommended for the nurse crops; seeded alone 150-200 lbs.

Grass seedings, 200-400 lbs. drilled in at seeding time.

Grass, old stands, 250-500 lbs. drilled 2-4 inches deep.

Vegetables, 300 lbs. or more worked into the soil, put to the side of row, or both.

Tobacco 250-400 lbs. bedded 3-6 inches deep in row or in bands about 3 inches to side and 1 inch below root crown.

Cotton, 200-300 lbs. bedded in row 4-6 inches deep 2-3 weeks before planting or 2½ inches to side and 1½ to 2 inches below seed.

Phosphate fertilizers or fertilizers high in phosphate should be worked into the soil to a depth of 2-4 inches in order to get the fertilizer down where the plant roots are and where there is sufficient moisture to dissolve the fertilizer. This can usually be done best in seeding small grains, clovers, alfalfa, and grasses by applying them through the fertilizer attachment of a grain drill. Where one of these is not available, it may be broadcast and worked into the soil with a disk, springtooth harrow, or field cultivator ahead of seeding. Fertilizer may also be mixed with the small grain and drilled through the grain hopper of a regular grain drill. Where this is done, however, the bearings and gears should be clean and well oiled before using and all the fertilizer thoroughly washed out of the drilling mechanism and all bearings well oiled afterwards.

The accepted practice in the past has been to apply fertilizer to row crops through a fertilizer attachment of a corn or row planter. Tests made with this method have shown better results where the fertilizer was placed in bands ½–3 inches to side of seed and at least as deep as the seed is planted. More recent trials seem to indicate rather strongly that, especially for summer growing crops like corn and soybeans, it may be advisable to turn the fertilizer under or place it in the bottom of the furrow when plowing the land. In dry seasons, there may be less possibility of injury when fertilizer is applied in this manner and it is deep enough to be in more constant contact with moisture, but not so deep but that the feeder roots can take advantage of it.

In purchasing commercial fertilizers, preference should be given the higher analyses in order to reduce to the minimum the number of bags needed, the cost of transportation, and the handling charges. The number of fertilizer analyses now on the market has been greatly reduced and it will likely become increasingly difficult "for the duration" to purchase straight nitrogen fertilizer, or mixed fertilizers containing as high nitrogen content as formerly.

Since vegetable crops are intensively grown, represent a higher acre cost, are used directly for human consumption, and their production and nutritive value are so definitely affected by the fertility level of the soil, areas devoted to such crops should naturally receive first consideration from the standpoint of proper soil treatment.

Fall-planted crops usually respond better to fertilizer than do spring- and summer-planted crops. The greatest return is usually received from fertilizers applied to fall-sown small grains which act as nurse crops for legumes and grasses, or from direct applications to grasses and sod legumes. Of the small

grains, barley, wheat, rye, and oats respond in about the order named. Alfalfa and red clover are usually the most responsive of the legumes. The grasses respond chiefly to nitrogen applied either as organic matter or commercial fertilizers. Sorghums, because of their more extensive root systems and their ability to withstand drought may give higher returns from fertilizer than will corn.

Deficiency Symptoms

By observing the nature of the growth of crops produced on the land, it is possible to determine with a fair degree of accuracy which of the more important plant foods may be deficient or, on the other hand, are sufficiently available for best growth. For instance, since nitrogen promotes vegetative growth, there is usually a luxuriant green foliage where it is plentiful and the supply of other nutrients is adequate. An excess of this element, however, tends to retard maturity and produce long weak stalks or straw, thus increasing lodging or falling down.

Nitrogen deficiency is usually first observed by a slowing down of growth, some plants becoming more slender, with relatively small stems and fewer branches. The loss of green color may be merely a paling or the development of a distinctly characteristic yellow color.

The lack of available nitrogen usually shows itself first in the lower leaves. The yellowing and firing proceeds upward on the plant and inward from the leaf tip with the edges of the leaves firing last. Symptoms of nitrogen deficiency in the midseason stages of growth may sometimes be hard to distinguish from those of drought.

A plentiful supply of available phosphorus in the soil stimulates earlier development of an extensive root system and tends to hasten maturity. Indications of phosphorus deficiency are often difficult to detect in plants. In the majority of cases, a lack of phosphorus causes a slowing down of growth with smaller yields of the seed or grain and a tendency towards delayed maturity. Abnormal growth conditions in corn, often called "purple corn," may indicate a lack of available phosphorus, although other unfavorable growth conditions may cause similar abnormal color developments. The addition of lime to lime-deficient soils has been shown to increase the availability of the phosphorus in the soil and of that applied in the form of fertilizer.

Lime, or calcium, may tend to prevent plant injury by keeping an excess of certain other elements from becoming available. Calcium or lime deficiency seems to show up most in legume crops. In cases of extreme deficiency the young plants may succumb to drought or winter-killing without developing very definite lime-deficiency symptoms.

Severe calcium starvation in legumes, like red clover, may cause white spotting of the leaves, similar to those caused by a deficiency of available potash. With it the leaf stems may wilt, while the leaf blades may remain turgid. All of these symptoms are usually accompanied by a decrease in growth. The acid reaction of the soil may reduce the availability of calcium and phosphorus and increase it in the case of iron, manganese, aluminum, and zinc to the point where they may become toxic or poisonous. On the other hand an excess of lime or calcium in the soil may reduce the availability of certain essential plant foods, especially potash.

Importance of Balance

If the various essential nutrient materials are available in the right proportion, a uniform deficiency of all of them may produce normal growth, but the plants will be small and the yield low. When only one element is deficient in an otherwise balanced soil, the growth rate is not only retarded, but the nature of growth is abnormal and some of the above deficiency symptoms will likely develop.

A deficiency of one element may also be essentially the same as an excess of all the other essential elements. Instead of a given symptom being one of plant-food deficiency, it could be caused by an

excess of other plant-food elements. It is also possible to have a large enough excess of some one plant food to prevent sufficient utilization of another element for normal growth. This may produce definite deficiency symptoms even though there may be an adequate supply of all essential elements present.

Light, temperature, and the amount and distribution of rainfall during the growing season may affect the quantity of the different plant foods required by the plant, and the amounts which become available. Because of this, certain plant-food deficiency symptoms may appear in unfavorable seasons even though there may be a fair balance of the total essential plant foods in the soil in available form. On the other hand, in abnormally favorable seasons deficiency symptoms may not appear even though there might be a definite lack in the soil of one or more of the essential plant foods. In case symptoms develop when there is a lack of more than one of the essential plant foods available, the most pronounced symptoms are usually those of the element which is most lacking. Furthermore, it is possible for the deficiency symptoms of one element to completely mask the symptoms of other deficiencies.

Nearly every available acre now produces some form of food, feed, fiber, or fat. Greatest returns of high quality products are secured from the land when we efficiently conserve and utilize all of the by-products of the farm and provide an adequate supply and balance of the plant foods essential for normal growth, through the addition of lime and the needed fertilizer elements.

"Lucky City"

(*From page* 26)

he thinks a lot of this crop. Last year he sold $300 worth of potatoes off this patch, and then planted it to corn and harvested 51 bushels per acre. He produced plenty of feed for all of the livestock on the farm, and sold $500 worth of corn.

How can Mr. Kehle cultivate so much land with so little labor? "A carefully planned system of farming that includes the maximum acreage in broadcast crops readily harvested with machinery, a planting schedule that spreads work as evenly as possible throughout the year, use of tractor power and machinery, and long hours of hard work" is his answer. When Alphonse went off to the Army, Eugene bought a milking machine and kept on milking the dairy herd. Big fields, long rows, tractor plows, two-row planters and fertilizer distributors, cultivators and combines, enabled him to do a lot of work in a day.

Fertilization is another answer to high production on the Kehle farm. Twenty tons of slag were applied on crop and pasture land this year. A complete fertilizer was used under corn and cotton. Limestone and phosphate were applied on permanent pastures. "Basic slag is the best thing ever put up in paper bags except sugar," says Mr. Kehle. He has obtained remarkable results from the application of this material on oats and lespedeza, cowpeas and soybeans, and on permanent pastures.

Mr. Kehle never goes to bed before 11:00 at night and is up around 4:30 in the morning. But in spite of the long hours of toil, he "enjoys farm life." He says he "likes to see things grow. That's where I get my pleasure.

I like to see the calves frolicking in the pastures, the oat fields waving in the wind, corn in the tassel, and the fields of cotton at fruiting time."

When Mr. and Mrs. Tony Klaas bought their present 80-acre farm, it was a picture of neglect and waste. On every side the fields were growing up in briars and bushes. The pastures were infested with weeds. The fences had fallen down. The house was in disrepair. The roof was caving in. The windows had been broken out. Some of the boards on the outer walls had been burned for fuel. One room had been used as a smokehouse. In the barn, the stables had not been cleaned out in so long that the manure had accumulated up to the level of the feeding troughs.

How the Klaases have improved the whole farm and built a modern home with all the comforts and conveniences of the city and the beauty of the country is one of the most inspiring stories I have found in farm life. The fields have been cleared of bushes and briars. Old pastures have been improved. New pastures have been established. A modern barn, a new milk house with adequate refrigeration facilities, brooders, and poultry houses have been built. A new smokehouse and storage room with double, insulated walls serves as a cool and convenient place to keep cured meats and all kinds of canned and preserved products.

The home has been completely remodeled and tastefully furnished. It has a fully equipped bathroom with hot and cold water, porcelain range, built-in cabinets, electric pressure pump, kitchen sink, breakfast nook, electric lights, and other conveniences.

Mrs. Klaas is proud of the family's war record. Mr. Klaas was in World War I and although she idolizes Bobby, who is 19, she said she "did not want him deferred." He left his employment in an aircraft factory at New Britain, Connecticut, where he worked 12 hours a day and where in eight weeks he won the Army's E for excellence and received a salary of $81 a week, to enlist in the U. S. Army Air Corps. Mrs. Klaas takes pride in showing visitors Bobby's handiwork. He has made a radio table, magazine rack, a model airplane, and other things. He has two rifles and is an expert shot.

The Klaases have already sold 1,000 friers this year and will raise 1,500 more. They milk 14 cows and produce milk, chickens, and eggs for the Food for Freedom Program. Marguerite and Henrietta, now in high school, help with the farm work when they are at home.

Mr. and Mrs. Tony Weisenberger have two sons in the service, Herman in Africa and Herbert in the Coast Guards. They have a big herd of dairy cows, fine pastures, and raise lots of oats and lespedeza hay.

Mr. and Mrs. F. P. Jerome have three boys. Francis, Jr., is an airplane mechanic, served in Australia, and took part in the battle of Tunisia.

Why "Lucky City" Is Lucky

Space forbids telling about all of the families in Gluckstadt and the magnificent contribution they have made to the war effort. But we will outline some of the main factors which have enabled them to make "Lucky City" one of the outstanding rural communities in Mississippi.

They have improved the fertility of the soil. They love the land. They husband every pound of fertility. They produce high crop yields. They grow either winter or summer legumes, or both, on all cropland. They plant a minimum acreage to clean, cultivated row crops. They raise a maximum of broadcast, soil-building crops. They carefully save all barnyard manures. They apply limestone and superphosphate on pastures and use mixed fertilizers under cotton. About one-third of all cropland is planted to oats and lespedeza, which protect the soil nearly the entire year, give two crops from the same land, and help maintain the supply of organic matter in the soil. Frequently, cowpeas are plowed under in September before planting oats in Oc-

tober. As a result, the yield of oats has averaged from 50 to as high as 80 bushels per acre. They plant good seed of the best varieties. This community has established a reputation for the excellent Texas Red Rust Proof oats which they grow.

Plenty of feed for all livestock is produced on the farm—corn and oats for grain; lespedeza, cowpeas, and soybeans for hay; corn and sorghum for silage. Cotton seed is swapped for cottonseed meal. Improved pastures play an important role in the dairy feeding program, and special pastures are built for hogs.

Probably in no other community in Mississippi will you find such adequate barns and buildings in which to store feed and house and handle livestock. All buildings are strongly constructed and arranged for convenience. Deep wells and water tanks provide plenty of clean, fresh water for livestock, dairy barn, milk house, and all necessary purposes. All buildings are electrically lighted.

Gluckstadt farmers make efficient use of improved machinery. They have tractors and tractor equipment, disk plows and harrows, manure spreaders, seed drills, cultivators, combines, mowing machines, corn binders, and feed grinders. They have some of the most complete and best equipped workshops ever seen on the farm. They repair practically all of their own machinery.

Cotton production is strongly supplemented with dairying and poultry raising, which bring in money every month during the year. Each family has from 15 to 35 dairy cows and from 100 to 575 laying hens.

These families "live-at-home." In addition to producing plenty of milk and butter, chickens and eggs, they have excellent gardens, can plenty of fruits, meat, and vegetables, and raise their own meat supply. The homes are painted, equipped with electric current, running water, and other conveniences.

The people are peaceful. They believe in law and order. It is significant that during the 37 years of its history, there has never been a single arrest or civil suit in the community—a record they are proud of. They have a splendid church, and they send their children to school in nearby Canton by bus.

Soil Conservation In Puerto Rico

(*From page* 18)

ployed by the Extension Service and other agencies.

Puerto Rico's role in helping to win the war may appear insignificant in comparison with the larger and wealthier countries to the north and south. But it should be borne in mind that the Island's lifeblood is dependent upon maritime commerce, involving the production and exportation of highly specialized crops eagerly sought after by other countries of the world.

Today the regular flow of maritime trade has been reduced to a trickle and this has seriously jeopardized, temporarily at least, the economy of the Island. The unified efforts being put forth by the crowded population toward self-sufficiency involving complex social and economic adjustments—and even a grim battle to survive—represent for this group of American citizens a major contribution and no small sacrifice. And upon proper use of Puerto Rico's soil resources may depend the survival of the people in this outpost of America.

Oneida County Salute!

(*From page* 5)

might get monetary returns on the true basis of yield.

After the Babcock test was released and plants began to use it a little, there was a flood of cuss words. W. D. Hoard, one-time Badger governor, said that only those farmers with Jersey cows liked the idea of measuring fat as a means of determining the production. So to make it agreeable, the intake boss put their cream into separate churns and churned it alone. The others who had scrub cows or cows with low butterfat production got identical treatment awhile. The natural result was that finally the owners were obliged to admit that there could be a difference in the yield from the same weight of milk. In the course of three or four years the ones with low butterfat cows found out that the remedy lay with themselves to correct by breeding, weeding, and perhaps by feeding.

OUT in the backwoods town where Henry and Babcock were partners, all this groping and hoping in the dairy world led them to make a decision. Babcock answered the challenge of Dean Henry by reflecting on what experiments he and Dr. Sturdevant had made. A rather new but awkward laboratory test invented by Soxhlet formed the original basis for the experiments that Babcock soon began with meager equipment. Taking a hint here and there, he slaved along quietly and slowly among his test tubes. When he thought the job was satisfactory on the modified Soxhlet method, he tried it out on the small herd kept at the college to supply milk to the professors' families.

His new test checked pretty well with the old one until the milk of one cow in the herd was tested. She was a grade Shorthorn somebody had named "Sylvia." Her milk did not respond in readings on the tube like that of her sisters. When Babcock reported this, many of the faculty said it would be all right to go ahead anyhow, as only one cow out of thirty would not mean much. Yet this was not the kind of a finished job that satisfied Babcock. He kept grinding away on the problem with his sulphuric acid bottles and at last he told the Dean that he believed the problem was solved and Sylvia's milk yielded to the test also.

TWO other questions followed. One was what kind of a handy device could they use to whirl the milk samples rapidly. Here the doctor's skill in physics led him to figure out the ordinary centrifuge machine, operated mostly by electric motor these days. The original hand-cranked outfit is kept in the Hiram Smith Hall.

The second and most vexing point was how to introduce it, maybe patent it. Everybody around the shop beamed on him, admired and envied him, and said he was on the road to riches. But this was contrary to Babcock's life outlook. He hadn't come out west like the voyageurs to get rich. If he could give something back to the industry that grew up with him, why that's all he wanted, thank you! "This device goes out without patent or legal hindrance for anybody to use anywhere anytime," was his final conclusion. Maybe that gesture instead of the labor he put on it has made his name a blessing for two generations.

He had a clutter of medals and certificates and resolutions aimed at him since those days of the nineties. Every prominent dairy nation and many leading dairy states showered him with honors and praise.

But whenever you visited his plain, little dwelling down there in Madison, you'd never get him to talk about himself without prodding. He would

much rather show you his garden of hollyhocks in the small backyard, or gossip about the chances for the New York Giants taking the world series.

This is not the end of the saga. The dairy test does not end it. Most folks think it does, but they are wrong. That's where we propose to enlighten them before we stop.

Most guys when they run across a fine new idea and put it to work exclaim "Eureka," and sit back to enjoy the spotlight forever and a day. Doc Babcock probably said Eureka to old Dean Henry and to Sylvia, but he didn't stop pondering and figuring by any means.

HE listened to lots of lectures and read heaps of dry-as-dust digests issued in those days about feeding cows. He did not agree with most of the silage savants that only energy, weight, and such mathematical gadgets must determine the value of various feeds and forages. He prodded some of his associates and nagged the younger student assistants constantly with teasing and vexing statements.

Once he was credited with telling a learned group of early-day feeding zealots that by all their accepted measures ordinary hard coal and hot water would be tip-top cattle rations. He proved it too on the blackboard, using energy and heat values. Babcock felt that there was some mystery hidden around somewhere in the grain bins, vegetable cellars, and hay fields. He kept everlastingly urging more and more scientific research by trained young students, aimed at the newer knowledge of nutrition.

Today, all you have to do to find out who is the father of the modern vitamin lore is to drop in and chat with E. B. Hart or Harry Steenbock. They and an associate, E. V. McCollum who also teamed along with Babcock and felt his influence, probably founded the school of vitamin research which has blossomed forth in almost every modern laboratory dedicated to the idea which Babcock nursed.

Meanwhile right after the dairy test was perfected, he and H. L. Russell got busy on some practical problems concerned with the storage of cheese. Their work led to the modern methods of temperature control and paraffining.

Neither did the advancing years deter this genial genius from further study. He really never grew old. At 84 years he remained active and deeply concerned with a problem that always intrigued him—the constitution of matter.

Nearly every day found him busy in the laboratory they reserved for him. He thought that he could prove certain points about changes in weight of objects and materials caused by chemical reactions and physical changes. He weighed and measured heaps of lead and took constant notes and readings. Maybe some of the facts he unearthed will be useful as references to other laboratory workers in years to come. At any rate, he rounded out the second half of his life in Wisconsin, as zestful and alert as when he arrived fresh from Geneva to tackle the big job they had cut out for him.

You could always get a ready response on any scientific topic from Dr. Babcock. He was able to converse with investigators in many sciences and crafts. His memory for detail was astounding, and he was a constant inspirational force for beginners.

AND then finally when relaxing time came and you forgot textbooks and leaned back in his easy sitting room to gossip about nonessentials, it would be wise to brace yourself a bit. For if you queried him during this off-period about his favorite piece of literature, he would poke around on a curtained shelf and hand you a dog-eared volume. Eagerly you grasped it and turned to the title page:

"The Life and Times of John L. Sullivan."

AVAILABLE LITERATURE

The following literature on the use of fertilizers in profitable soil and crop management is available for distribution. We shall be glad to send these upon request and in reasonable amounts as long as our supply lasts.

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Fertilize Potatoes for Quality and Profits (Pacific Coast)
Better Corn (Midwest) and (Northeast)
The Cow and Her Pasture (General)
Fertilize Pastures for Better Livestock (Pacific Coast)
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THE AMERICAN POTASH INSTITUTE
1155 16TH STREET, N. W. WASHINGTON 6, D. C.

CHISELING

"Now, I'm telling you, Abie, there's a real suit of clothes. The material you can't beat it. The style is right up to tomorrow, and it fits you like nobody's business. An $80 suit of clothes, Abie, but I'm not charging you that; nor $70; nor even $60 yet. I'll tell you, Abie, what I'll do; I'm making you that suit at $50 flat!"

"Well, Jake, I'm liking the suit okay, but I'll not pay you $50 for it; nor $40 either; no, not even $30. I'm paying you $25 for this suit, Jake, and you should take it or leave it."

"Sold! That's the way I like to do business, Abie; no chiseling."

The Queen Bee is a hardy soul—
She thumbs her nose at birth-control;
Which is the reason, without a doubt,
That many sons of bees are round about.

THINGS TO WORRY ABOUT

Sweet Young Thing: "What shall I do? I am engaged to a man who just simply cannot bear children."

Kindly Old Lady: "Well, you mustn't expect too much of a husband."

Briton: I'll bet a pound.
Yank: I'll raise you a ton.

Question on recent examination paper: "If the President of the United States died, who would get the job?"

Little Joe's answer: "A Democratic undertaker."

Court Clerk: "Sorry, Madam, but a license will be issued only when your form is filled out properly."

Bride-To-Be: "Sir! I like your nerve. We can get married no matter what I look like."

"Why ain't you in uniform?" demanded a truculent young dame of a deferred gent the other day.

"Why ain't you?" he rejoined tartly.

Dogs in Siberia are the fastest in the world because the trees are so far apart.

HIS JOB'S DONE

Just before a recent North African battle was begun, the commanding officer shouted, "The Germans are coming, men, but we're outnumbered 4 to 1, so do your stuff."

Joe, a Kentucky mountaineer, began to blaze away but in about five minutes he stopped and leaned his rifle up against a rock.

"What's the matter?" asked the officer.

"Well, I got my 4," replied Joe.

"I can tell your fortune."
"How much?"
"Twenty-five cents."
"Egad, that's right."

American ends in "I CAN."

Did you hear the story of the lawyer who sat up all night trying to break a widow's will?

Need for—

BORON IN AGRICULTURE

Authorities have recognized that the depletion of Boron in soil has been reflected in limited production and poor quality of numerous field and fruit crops.

Outstanding results have been obtained with the application of Borax in specific quantities or as part of the regular fertilizer mix, improving the quality and increasing the production of alfalfa and other legumes, table beets, sugar beets, apples, etc.

The work of the State Agricultural Stations and recommendations of the County Agents are steadily increasing the recognition of the need for Boron in agriculture. We are prepared to render every practical assistance.

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Bringing Citrus Quality to Market
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Potash from Soil to Plant
Potash Deficiency in Grapes and Prunes
New Soils from Old
Potash Production in America

We shall be pleased to loan any of these films to agricultural colleges and experiment stations, county agricultural agents, vocational teachers, responsible farm organizations, and members of the fertilizer trade.

Requests should be made *well in advance* and should include information as to group before which the film is to be shown, date of exhibition (alternative dates if possible) and period of time of loan.

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POTASH IN NORTH AMERICA

By J. W. TURRENTINE

President American Potash Institute

AMERICAN CHEMICAL SOCIETY MONOGRAPH NO. 91

• • •

AMONG American chemical industries that have attracted national and international attention due to their war-emergency performance, few have exceeded the American potash industry.

This interesting and well-written survey of the development of the American potash industry during the last fifteen years is particularly important at the present time, when the food problem is second in importance only to the war itself. After a brief review of the present sources of potash, complete details are given as to production, both domestic and foreign; present status of the industry; and its future prospects. Special attention is accorded to Carlsbad, N. M., and Searles Lake, Calif., developments, and to the fundamental technology of potash. This important volume has been made unusually attractive by the inclusion of a large number of exceptionally good photographs of all phases of the industry.

Dr. Turrentine, of the American Potash Institute, is one of the country's leading authorities in this field. His work will be welcomed as a most significant addition to the literature of the subject by all who are interested in any way in the production and use of potash and related products. This book will be required by public libraries, as it is the only source of reliable information on the current status of this vital resource.

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